Sterilization of Instruments and Use of Distilled Water in Oral Cavity.

By W. A. Barber, D.D.S., Springfield, Ohio.

The reigning power in the healing art for the past few years has been bacteriology.

Every few months the medical world has been aroused by some wonderful discovery of some new specific germ, hence a fresh incentive to combat disease.

Bacteriology.

No branch of medicine has more quickly grasped the value given to the practitioner by recent bacteriological research than dentistry. Nothing can be more convincing along this line than to contrast the treatment of pulpless teeth as it was generally practiced twenty-five years ago with the recognized treatment of the present. At that time any work involving the root canals of a tooth was dreaded by every practitioner, while now all such work is commenced and finished with ease and certainty of success that must follow when due precaution is taken to eliminate every source of infection.

The enormous increase in the number of teeth which are preserved to humankind in this twentieth century can be traced directly to the stimulus gained from the results of bacteriological research. The study of bacteriology is enforced in the curriculum of our most advanced dental colleges. The growing importance of this subject, in relation to dental pathology, has necessitated certain modifications in the technique of nearly all dental operations. A clear knowledge of the practical details

of bacterial life has become essential for successful dental practice just as it has for all branches of surgery.

The graduate from the dental college of today is equipped with information that will not only enable him to correctly apply the most improved methods for preventing and combating bacterial action, and to develop an efficient system of antiseptic technique in connection with his practice, but he is also trained in methods that will make it possible for him to study the bacterial factor, which is the cause of diseased conditions in special cases arising in his practice.

Sterilization.

The prominence that is given this great subject by the scientific minds of the day is calculated to startle and arouse the dental practitioner of twenty or even five years ago to the necessity of sterilizing every instrument that has been used upon a patient.

An intelligent and discriminating public, as well as thoughtful and scientific professions, demand a radical and permanent change in office methods in daily practice, and that change is from a careless, slipshod system to one founded upon modern and scientific discoveries.

I shall take it for granted no one will take issue with statements made in regard to conducting a dental practice on lines in accord with our present knowledge of the dangers that may be feared from various micro-organisms, and shall present a few practical points along this line.

The writer has had an opportunity of visiting a large number of operating rooms of prominent men, and seen explorers, scalers, forceps and almost all kinds of instruments used in mouth after mouth, with only a superficial rinsing in water and drying intervening. That is not sterilization.

It has long been a favorite idea among certain medical men that dentists are spreading contagion, particularly syphilitic contagion, broadcast.

Can you blame them when you realize how great a number are afflicted with this disease, and the fact that adequate means for the sterilization of instruments are not employed in a great many dental offices? There are, undoubtedly, grounds for criticism.

One reason for failure to properly sterilize their instruments is the lack of an inexpensive and convenient method of sterilization. This has operated more to prevent improvement in this respect than anything else.

Again we find dentists who use the utmost care in regard to instruments, yet who will lacerate tissue in a mouth and use water from a hydrant to wash out the mouth after extraction or other operations necessitating laceration. Does the surgeon operate in such a haphazard way? Certainly not.

We cannot even touch any point in the oral cavity without our instruments becoming coated with a layer of infectious material.

We can never know what virus may be clinging to our instruments, nor can we, with certainty, predict the result of a wound upon the cheek, the gums or lips with an unclean instrument.

How easy a thing for a dentist who is unclean, and who, for instance, has used his instruments on a diphtheritic patient and failed to make them surgically clean, to inoculate some other patient upon whom he uses the same instrument. In like manner pus germs may readily be carried from patient to patient.

I shall first speak of the sterilization of instruments. Some dentists make a practice of washing in cold water and carefully drying all instruments after every operation; others immerse them in hot or boiling water; others dip them in some fluid possessing supposed germicidal properties; but bacteriology demonstrates to us that such methods do not necessarily accomplish sterilization.

How, then, can it be accomplished, or how shall bacteria be destroyed? Muir and Ritchie say that all bacteria can be killed, either by heat, drying, starvation, or by chemical agents. Of the four methods of destroying bacteria only two can be utilized for sterilizing instruments, namely, heat and chemical action. The last named does not meet all requirements of a sterilizing agent for a dental office, not only because of the time required in some cases for complete sterilization, but because of the corrosive action on steel instruments.

All bacteria are destroyed by heat, and this method has met with great favor on account of many advantages it possesses over other methods.

It would be far from necessary to elaborate upon the question of heat sterilization of instruments used in all cases. If you keep in touch with the methods of the best surgeons you will find they consider boiling the instruments the only sure method of sterilization. There should be no suspected cases. All should be treated alike, acknowledging the utter impossibility of knowing positively whether a person is free from an infectious disease.

Cleanliness, above all things, is necessary to a successful treatment of all diseased conditions of tissue. Not ordinary cleanliness, in all its general acceptation, but surgical cleanliness, and there is a vast difference between them; to be surgically clean is to be germ free.

Dr. W. D. Miller says there is no department of surgery which demands more thorough sterilization, and recommends an exposure of from three to five minutes to a boiling one or two per cent. solution of soda for sterilizing dental instruments.

Upon entering the practice of dentistry I searched in vain for a sterilizer that would meet my requirements. They all belonged, apparently, in the laboratory equipment, and I did not consider that the proper place for a dental sterilizer. The modern sterilizer of a dentist's outfit should be as good theoretically as it is practically. You should not need to tell your patients you sterilize your instruments; you have enough to tell them along lines of vast importance and about things you are unable practically to demonstrate.

Distilled Water.

Another feature I realized the necessity of—hot distilled water at all times, for use in the oral cavity, and I did considerable experimenting until I obtained a sterilizer combined with a distilled water attachment, and I have nothing in my outfit that has given me as much satisfaction as this sterilizer with a distilled water tank. Distilled water tank entirely separate, no chance for water to be contaminated, and always hot. Same burner used on bracket table answers for heating, and when burner is not in use, keeps small flame under sterilizing pan, compact, neat and practical.

The question of the value of asepsis and antisepsis in all operations in the oral cavity is no longer one of controversy. The statistics of surgical operations of all kinds before the days of Lister, contrasted with those of the last two decades, are sufficient proof of the value of asepsis and antisepsis in surgery.

The best dental surgeons the world over admit their value, and attempt, as far as possible, to carry out the principles of this method of treatment.

Leading men in our profession, such as Black, Williams, and a host of others, realize this fact and are devoting their time and energy along this line, so that in a short time a dentist who does not understand this subject will be regarded as a "back number," and will be placed in the category with those who yet fail to recognize the advantages of antiseptic dentistry. With a recognition of this established science guiding us in our future investigations and practical work, what triumphs may we hope for?

Who knows but that by early preventive treatment caries may be a thing of the past, the inflammatory diseases of tooth environments crushed in their incipiency.

The bugbear of dentistry, Riggs's disease, eradicated, and even the crowning of a tooth ceases to be an art by the conversion of dentistry into a preventive science.

A Few Reflections on Pyorrhoea.

By Dr. H. N. LANCASTER, Chicago, Ill.

At the beginning of this article I wish to state that I write it with the desire to express a few thoughts incidental to the subject of pyorrhœa alveolaris, and with the realization that to many it will probably be a discordant note, and that the thoughts therein set forth will perhaps not be received with great favor in some high places.

At the outset I would submit a definition and a proposition. First: "Superstition is belief without evidence; belief in spite of evidence." It is the homage that the more enlightened present pays to the more ignorant past. Second: That few—very few—persons, where there is not sufficiently conclusive evidence to establish fact, hold to a belief that is not pleasurable. It is true that hell, for instance, is not a pleasant idea; but few are they who pin their faith to it and do not indulge in the pleasurable belief of immunity for themselves.

Almost all agree that pyorrhœa is a premium paid by many of the human race for civilization: the result of artificial and uncleanly careless habits and conditions; of complicated, improper diet and unnatural lives. But here the beaten paths diverge and lead, one to the idea that pyorrhœa is the local manifestation of a constitutional disease; the other that it is a disease of purely local character influenced by that mysterious, indefinite thing called "idiosyncrasy." The latter theory being more material, more tangible, is the one to which I would more particularly refer.

If we will discard, for the moment, the more or less involved terms, constitutional "idiosyncrasy" and "diathesis," and substitute the word "vulnerability," we will simplify matters much and exclude the idea of tendency, leaving us in a position to more clearly view the condition of vulnerability on the one hand and immunity on the other.

In the mature human subject we find the well-known conditions of gingival inflammation and pockets and pus, of wasting bone and loosened teeth, too familiar to need description. How does this take place? Those who are immune doubtless owe their immunity to an inherent resistance and a normal oral anatomical construction, plus their care. In the case of those who are not immune, and who fall prey to the disease, it is due to a vulnerability or lack of the inherent resisting force more than to any constitutional tendency.

It is of course not to be overlooked that a very potent predisposing cause may be found in a mechanical fault in the shape of a tooth or teeth,

or a malposition of a tooth or teeth, these being most important factors and partaking of the character of active rather than passive conditions, inviting and retaining the initial deposits of salivary calculus.

The salivary lime salts being, in a sense, physiologically thrown down out of solution, and lodging upon the necks of the teeth, and being allowed to remain there, produce a mild, slow and persistent inflammation.

This inflammatory condition of the gums at their free margin is of a slightly acid character. Now the alkaline blood coursing through this profoundly vascular tissue has for thousands of years been accustomed to find there an alkaline environment. But when this inflammatory condition prevails it is thrown abruptly into an area of acidity. The result of this is that mineral salts in the blood are thrown out of solution and find lodgment on the roots of the teeth. This in its turn becomes the cause of another effect and an increase of acidity results, which again causes more deposit. The process is cumulative, and the two factors of increasing inflammation and acidity and more deposit go on and on, hand in hand, until the tooth is lost; and it seems reasonable to believe that this can occur purely locally and without constitutional complications.

Now as to the treatment. The markets are flooded with various medicines designed and recommended for the treatment of pyorrhœa, both by local application and constitutional administration, and still we hear cries for more. If the deposit on a root is completely removed the case will get well without the use of the complicated combinations of antiseptics so much in vogue; but the deposit must be mechanically removed, even if it is necessary to extract and reinsert the tooth to do so.

The idea that pyorrhœa is the local manifestation of a constitutional disease, and the complicated systems of medicinal treatment born thereof and used therewith, have taken on the character of dental superstitions, and the mental processes involved therein are clearly apparent. When the dentist works on a tooth root, blindfolded as it were, and works faithfully for an hour or more to remove the deposit, it is pleasurable for him to believe that he has been successful. Perhaps he has; perhaps he has not. If he has, the tooth will get well. If he has not, the disease will still persist. However, he uses, for a time, some antiseptic, which he squirts into the pockets at intervals. When he ceases the use of the medicine, if he has not completely removed the deposit, suppuration will again become established.

But he still believes he has removed all the deposit; and the disease still remaining, he naturally turns for shelter to the pleasurable belief that pyorrhœa is a constitutional disease, and asks the patient if he has ever had gout.

In this connection it may be well, supposing the uric acid diathesis

theory to be true, to ask if it is not somewhat remarkable that those who have pyorrhœa generally seem to be immune to rheumatism and to gout.

Not only do drugs used in pyorrhœa pockets fail to cure the disease if the deposit is not removed, but they are unnecessary if it is removed. And not only are they unnecessary in that case, but they are a hindrance and delude, leading the operator, by the *suspension* of suppuration, to believe that the disease is cured, and leading him also into vague (though pleasurable) theories as to the constitutional origin of the disease and treatment in accordance therewith.

Draper, in "The Intellectual Development of Europe," says: "Man is ever prone to mistake coincidence for cause," giving as an illustration that the Egyptians regarded the Dog Star as the cause of the overflow of the Nile, because they rose in conjunction. Just so does the dentist, when he sees that his drugs cause a *suspension* of the suppurative process, think he is approaching a cure.

The Treatment of Facial Neuralgia.

By E. M. Steele, D.D.S., Stephens City, Virginia.

The multiplicity of our modern drugs and the highly vaunted healing attributes of many of them, whether worthy of pharmacopeal recognition or not, render extreme caution and intelligent choice a necessity on the part of the prescriber. Intelligent and accurate observations of the results of successive administrations of a remedy or a combination of remedies certainly establishes a basis of safety and conclusive proof upon which one may place reliance. In a combination of remedies each element with its peculiar properties should be selected in strict accordance with therapeutic principles. Such a combination is ably represented in hemicranin in the treatment of the various neuralgias, particularly in facial neuralgia or neuralgia of the fifth cranial nerve.

In the practice of dentistry complaints neuralgic in character are quite common, and it is important, if not actually necessary, that we should have a drug suitable for such cases that we could administer with confidence, sure that the results wished for would be attained properly.

In my practice I have tried many antineuralgics with varying degrees of success, and in the end have found hemicranin to be the most satisfactory in every respect in the treatment of the complaints above named. Much objection has been raised to the use of many of the coal-tar prod-

ucts having sedative properties, on account of their depressing cardiac influence, but it is conceded that phenacetin is the least injurious, and when supported by caffeine the source of danger is doubly removed.

There has been much discussion pro and con on the treatment of facial neuralgia, but I submit the following clinical reports in which hemicranin has given highly satisfactory results in the neuralgic conditions referred to above:

Case I. Patient, a lady, had suffered for years with a severe trigeminal neuralgia. She had been treated by many physicians with little success, and received temporary relief only from hypodermic injections of morphia. These attacks occurred at irregular periods of time, but averaging four to five a month and gradually increasing in severity. Finally she had all the upper teeth extracted with the hope of obtaining relief, but with no beneficial results, as the neuralgia continued. When the patient came under my care with this history I commenced the administration of hemicranin in ten-grain doses with the result that immediate relief was secured. Since that time a few attacks have occurred, but they were much less severe in character and diminishing in frequency, succumbing to the influence of hemicranin. At the present date over a year has elapsed without a return of these attacks.

Case II. Mr. S., a minister, aged 50 years, gives a history of facial neuralgia following exposure to cold. He attributed his trouble to a number of large amalgam fillings in the bicuspids and molars. I made an examination and found that the teeth were not the cause of the trouble, and upon eliciting a detailed history, made a diagnosis of trigeminal neuralgia. The ophthalmic division being principally affected, I administered five-grain doses of hemicranin, with directions to repeat the dose at intervals of one hour until fifteen grains had been taken. The patient was pleased to report to me several hours later that he was completely relieved.

In my practice, as in the practice of most dentists, I find a great many of my patients complaining of pains of neuralgic origin which they attribute to their teeth, thus coming under my care for treatment. I have treated a number of cases in the past twelve months similar to the ones given above, and without a single exception have found that hemicranin was always to be depended upon to give prompt relief.

I may add in closing that I have found hemicranin to be singularly free from the depressing effects so common to drugs of a like nature, and when administered for neuralgic affections commonly met with in dental practice, I have found nothing that would take its place.

A Modest Claim.

By Dr. JAS. B. HODGKINS, Washington, D. C.

When a man, after he passes the sixty line, starts up and says of some new and freshly discovered matter, "I did all that years ago, but said nothing about it," he is apt to be smiled at, so apt is a discoverer to parade his discoveries in print, or before an association. Still it is not at all uncommon for two thinkers, far apart and not even knowing each other, to evolve the same thought entirely independently of each other, and each deserve equal credit for his discovery.

I am led to make the above observations on turning over the pages of *The Southern Dental Journal* for August, 1887, and finding there a paper read before the Southern Dental Association by myself, entitled "Amalgams," I may with great modesty say that at its conclusion the late Dr. Wm. A. Morgan, Dean of The Vanderbilt, came to me and remarked that it was the most scientific paper on that subject he had ever heard. After some preliminary observations on the "unexpected behavior of alloys," the paper goes on to state:

"What is true of the most simple alloys, as to irregularity of behavior and unexpected tendencies, is true to a still greater extent as we rise to the complex in the alloying of amalgams so called. Here the problem is indeed intricate. If copper confers on silver certain peculiarities it had not before, then when we add to these in the melting pot gold, platinum, zinc, tin, antimony, and I know not what else in varying proportions, and when these are all melted together, all obeying laws of crystallization and having tendencies to separate from each other, making different chemical compounds with some and mechanical mixtures with others, we see how complex the problem begins to appear.

"Now when there comes in the amalgamating metal, mercury, reducing what was before a solid to a soft, plastic mass, letting loose combinations which before existed, and making new ones with the mercury, and when to all this a still more highly complex crystallization is set up and the mass "sets," it is only in the power of a brilliant imagination to follow out and picture the molecular arrangement. Still more imagination is called for to describe the chemical action of this mass on itself or on its constituent parts, and on the tooth-substance against which it rests.

"We must accept the evidence of our senses, and these teach us that the tendency on the part of all amalgams is to change shape more or less, which change we call the spheroidal tendency. This inclination to creep

or change is characteristic of all amalgams, and so far as I know, the addition of any one or more metals has not a full controlling effect on this action.

"All amalgams shrink, except the copper amalgam of Sullivan, and the Palladium. All the amalgams experimented on by Dr. Bogue contracted, and he made careful and exhaustive experiments with a great many. From the experiments of Dr. J. Foster Flagg we learn that contraction and a tendency to assume the spheroidal form is a characteristic of about all alloys when amalgamated.

"Beyond and behind this fact of an immediate change of shape there is an apparent slow change. A year shows 'crevicing;' a line of separation is seen, more or less defined, between the cavity wall and the filling. We are slow to believe this due to a molecular change in the mass of the filling, because we have accepted the theory of definite crystallization, and assumed that, this process completed, this is the end of change.

"Yet changes take place in substances much less complex than amalgam, changes we may overlook, and which may throw some light on the subject before us.

"I hold in my hand a stick of sealing wax. A sudden strain snaps it, and it seems quite brittle. I fasten an end projecting horizontally from a vise and attach a slight weight to the free end. It will slowly bend. We call this viscousness.

"I examine the mortar between the bricks of a building one year old. It has 'set' perfectly, but it may be scratched with the finger-nail. Twenty or fifty years after it is very hard, and at the end of centuries is as hard as the brick it holds in place. Yet this mortar 'set' at first, and seemed quite crystallized. What slow change in its structure in the course of time made the change from soft to hard? Our query is unanswered.

"Ice, as is well known, possesses this viscousness, and the glacier flows down the valley, all the time keeping as solid as ice, and yet accommodating its surface and shape to the varying shape of the valley down which it flows. It flows readily under pressure.

"I go into a candy shop and call for black taffy. The shop girl takes up a piece, strikes it with a knife, and it snaps as readily as a bit of glass; yet I may take a piece of the same taffy and apply slow pressure, and it readily bends and changes its shape.

"I quote these familiar facts to show that the laws of crystallography, or those laws governing bodies passing from a soft to a hard state, or already 'set,' are but dimly comprehended, and that after all that has been studied and written on the subject, and with all the practice with amalgam it is a mysterious subject still.

"One deduction seems fair; that is, that that complexity of structure

or composition—the intrusion into a body of many constituents—is of doubtful utility, from a philosophic standpoint. If the laws of definite crystallization so far as we apprehend them, speak anything to us, they seem to say that in proportion as we add constituent elements we lose control of expected results. A silver crystal is one thing, a tin another, copper still another, and so on. It may be that one may control another in the setting, but is it likely? The simplest alloys for amalgamation are those which contain metals in themselves tough. We see this in the familiar formula of Laurence. Add zinc, antimony, or other brittle metals and it is likely that we get as good results."

The above extracts from the paper in question seem to shadow forth the doctrine of "flow" as expounded by Black in later years, and possibly may give the writer a fair claim to have thought out beforehand the results which were proven so brilliantly by Dr. Black in after years.

Insertion of Gold Fillings in Artificial Teeth, as Applied to Crown and Bridgework.*

By Hart J. Goslee, D.D.S., Chicago, Ill.

(Indications. Methods: Foil Gold, "Roman" Gold, In Combination with Backing; Procedure.)

The insertion of gold fillings in porcelain facings employed in the construction of crowns and bridges is very often indicated as a means of simulating the remaining natural teeth, and thus observing, and complying with, the requirements of *harmony,* and with a view to and for the purpose of obtaining increased esthetic and artistic results, as has been previously mentioned.

Indications. In the construction of individual crowns for any of the anterior teeth, if the remaining adjacent natural teeth are more or less freely filled with gold, the crown should almost invariably carry one, and sometimes two, small approximal fillings; and in bridgework involving the upper anterior teeth, where the lower anterior teeth are likewise filled, the insertion of one or two small fillings in appropriate locations will often aid materially in

detracting from the artificial, and adding to the natural, appearance of the work.

Such fillings should never be inserted, however, with a view to making the work conspicuous, nor for the exclusive purpose of additional remuneration, and should be no larger than necessary to effect the *harmony* and *legitimate deception* which may be thus indicated by the surrounding environments.

Methods. The methods employed in accomplishing this work consist in preparing a retentive cavity and filling it with foil gold; in the use of liquid or "Roman" gold, which is painted over the desired area, and then *fired* in the furnace, in a manner similar to that employed in china decorating; and the construction of the filling as a part of the backing.

Foil Gold. In the employment of this method, which is perhaps the most generally used, and which affords the most permanent, expeditious and artistic results, a cavity, in the appropriate location and of the desired form, should be first

Fig. 154.

outlined in the facing with a small fine carborundum-stone. (Fig. 154 A.)

This outline facilitates the cutting or drilling of a cavity of the necessary retentive form and affords a definite marginal edge for the subsequent adaptation and finishing of the gold.

When so formed, adequate retention may then be secured by drilling a simple countersunk cavity of sufficient proportions in the center of the outlined area (Fig. 154 B), or by cutting retentive grooves (Fig. 154 C).

For the former purpose, which is more generally applicable to small cavities, an inexpensive diamond drill, to be used in the engine, is made by the S. S. White Dental Manufacturing Company (Fig. 155 A), while the retaining grooves, which are best adapted to larger cavities, may be easily cut with a small copper disk coated with diamond dust, which is also prepared for this and similar purposes (Fig. 155 B), or with the "cavity cutting" outfit manufactured by the same company, and which

consists of a set of engine instruments of oval form, and graded sizes, and a cutting material composed of carborundum dust and glycerol.

While this latter method accomplishes the work nicely, it is scarcely so expeditious as the two former procedures, in the use of which the rapidity of their cutting properties is facilitated, and the danger of fracturing the facing is entirely eliminated, by the free use of oil or glycerine as a lubricant. This saves the instrument, and prevents the creation of heat otherwise induced by friction, which might cause fracture.

When the proper retention has been secured, the cavity should be thoroughly cleaned with soap and water and dried with alcohol and air, and then filled with small pellets of gold in the ordinary manner, and finished as usual (Fig. 154 D).

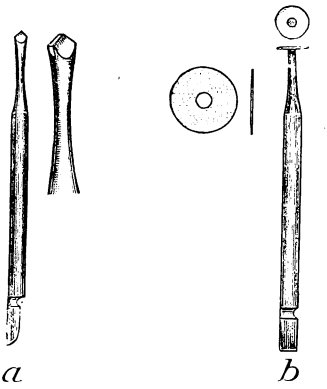


Fig. 155.

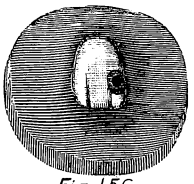


Fig. 156.

While it is usually advisable to defer the insertion of such fillings until after the completion of the work, in order that any subsequent scratching or defacing of the surface may be prevented, it may frequently become necessary, or seem desirable, to insert them before the construction of the work, or the assemblage of the parts.

This may be essential in bridgework constructed with gold to admit of placing the cavity in the desired location upon the approximal surface, and when here or otherwise indicated the procedure may be greatly facilitated by imbedding the facing in a base of modelling compound or sealing wax, as a means of holding it securely (Fig. 156).

In porcelain work, however, the procedure must necessarily be deferred until the piece has been finished, in order to preclude fusing the gold, and the same is likewise advisable in single crowns, for the reason

mentioned, and in any event the preparation of cavity and insertion of filling should be done at the same time.

Roman Gold. In the use of the so-called "Roman" gold, which is prepared for similar decorative purposes, and quite applicable to this, the cavity area should be first outlined, as indicated in Fig. 154 A, and the gold then mixed into a paste of proper consistency and painted thickly over the surface, being careful to observe that it closely follows and evenly approximates the cavity margins.

The facing should now be placed near a flame, or close to the previously heated furnace, and allowed to remain until the gold has become *thoroughly dry,* when it should be placed in the furnace and "fired" until the gold fuses, which may be readily observed by its *vitreous* appearance.

After allowing to cool more or less slowly, the filling may be easily finished and polished with burnishers, or *fine* cuttle-fish disks, and the buff wheel.

Fig. 157.

In gold work such fillings should be made *before* the final attachment of the facing to the metal parts, with solder, while in porcelain work the lower heat required to fuse the gold demands that they be made after the completion of the piece.

While this method affords artistic results, the objections to it lie in the fact that such fillings are likely to be less permanent, because of a tendency to flake and chip.

In Combination with Backing. A method involving a less simple detail, and requiring more time, perhaps, but productive of very artistic results, is applicable to gold work, and consists of making the filling in combination with and as a part of the backing.

Its employment is indicated more especially, however, in simulating approximal fillings involving the incisal angle, which is sometimes desirable, and which would be more or less difficult by the other methods,

because of the limited opportunity afforded by the ordinary facing for securing adequate anchorage for such fillings.

Procedure. When such fillings are indicated, or where it may be desirable to employ this method, the facing should be first ground to the proper and required adaptation, and then prepared for the reception of the backing, in the usual manner.

That portion of the porcelain which involves the location and area of the desired cavity formation and gold restoration should then be ground away on a *slight bevel toward the lingual side,* until a perfectly smooth marginal outline has been secured (Fig 157 A).

A backing of about 34 gauge pure gold should now be adapted to the facing, and burnished up well against the cavity margin, allowing a surplus of about 1/32 of an inch to project beyond the latter, and upon the incisal end (Fig. 157 B). When this has been accomplished, a piece of 22 karat gold plate, 29 or 30 gauge, should be adapted to this, extending from the pins to the incisal end, and projecting out to the original outline of that portion of the facing which has been destroyed (Fig. 157 C).

This forms a matrix, indicating the desired formation of the filling, and the two backings should now be removed and united with solder in the manner previously described in connection with "re-enforced backings." Their detachment from the facing without danger of changing the shape of the thinner one is made possible and facilitated by the slight lingual bevel given to the cavity wall in its preparation.

When their union has been effected, the matrix formed by the two backings should be filled with 22 or 20 karat solder until the desired contour obtains (Fig. 157 D).

This should then be adjusted to the facing, securely attached by bending the pins, and finished with files, stones and disks until the adaptation of the backing and the contour of the filling are as desired (Fig. 157 E), when the piece may be completed and finished in the usual manner.

In securing the desired contour of the filling with solder, a high karat must, of course, be used, because of the susceptibility to discoloration, and clean flux must be applied to avoid a pitted surface.

In flowing the solder, it is also well to observe the precaution of fitting a piece of gold or platinum wire or plate into the matrix before the procedure, as this insures a preservation of the adaptation of the pure gold to the cavity margin, which otherwise might be somewhat changed by shrinkage, if solder alone be used.

The Filling of Teeth with Porcelain.*

By WALTER WOLFGANG BRUCK, D.D.S.†

Translated from the German by N. S. Jenkins, D.D.S., Dresden, Germany.

Introduction.

Although the number of preparations used in the filling of teeth attacked by caries is constantly increasing, and although, owing to their varied qualities, we are able to select from them in each instance the one best suited to the individual case, yet until now we have never had a filling material that could without qualifications be described as "ideal."

The Ideal Filling.

Prof. Miller, in his book on "Conservative Dentistry," has summed up the qualities which the ideal filling material should possess as follows:

(1) Sufficient strength: that it may neither break nor wear away under the stress of mastication.

(2) Chemical indestructibility: that it may remain unaffected by the fluids of the mouth, or by any food or drink.

(3) Permanence of form and volume in the mouth.

(4) Thermal nonconductivity: that changes of temperature in the mouth may not be conveyed to the pulp.

(5) A high degree of adaptability: that it may be made to fit the walls of the cavity so closely as to exclude moisture.

(6) Color resembling as nearly as possible the color of the tooth to be filled.

(7) Absence of every quality injurious to the substance of the tooth, including the pulp, or to the mucous membrane, or to the general health of the patient.

(8) Ease of insertion.

(9) The least possible susceptibility to moisture.

Among filling materials we indeed possess some upon which we can depend for good results—for example, gold—and, thanks to the thoroughness with which Dr. Witzel has developed the uses of *amalgam,* we are

†Instructor in the Dental Institute of the Royal University of Breslau.

able with this material to save teeth which formerly could not be preserved. Other preparations, the *cements* and *gutta percha,* often render us good service; but there is no one of these which unites in itself all the requirements, none in which we may absolutely trust, none which deserves to be extolled as the "ideal filling material."

On account of its durability gold must always stand in the first rank, but gold fillings in the front teeth are certainly not beautiful. Amalgam cannot be considered in such cases, both on account of its dark color and because it often causes discoloration of the tooth; therefore our only choice has been gold with its shimmering lustre, or one of the plastics like cement, which disintegrates in a comparatively short time. For defective front teeth we need a material that shall be at least as durable as gold and more sightly.

As I shall take the opportunity to show, for many decades dentists have been striving to find such a material. In earlier times it was naturally more difficult to attain this end, for the dental instruments and appliances with which dentists worked left much to be desired, and the manufacture of artificial teeth, which has furnished incentive for many attempts in this direction, had not reached the perfection of today.

With the increasing perfection of tools and especially of dental appliances we are now in a position to employ a method of filling that fairly represents the most perfect dental achievement.

The porcelain filling is very nearly the ideal filling, and when we consider one by one Prof. Miller's requirements for an ideal filling material, we shall find that porcelain meets most of these demands. If there be still some minor defects in the methods employed in the use of porcelain, we may hope that they will be remedied in the not too distant future; in any case a field of experiment is offered in which we can expect brilliant and useful results.

Historical Development of Methods of Porcelain Filling.

In turning over the leaves of the dental literature of past decades, when the science was still in its cradle, and there was not even *one* trustworthy material for filling in use, it is interesting to note the wish, often expressed, of finding a material that should satisfy the æsthetic sense by approaching the color of the teeth. I regard these writers as the intellectual originators of a method of filling which is not only suited to bring about a revolution in this department in our time, but is also destined to have an important influence on the future of operative dentistry.

The first to take up this kind of work was C. J. Linderer, who in

1820 described processes which he named "*fournieren*" and "*plattieren*" (inlaying and veneering) of the teeth. His son, Joseph Linderer, improved on his methods and published a book describing them in 1834.

The *plattieren* of teeth succeeded best with shallow cavities, for which were used small flat pieces of walrus or rhinoceros tooth, shaped to fit the cavity. If the depth of the cavity allowed, small pins were set in the piece to give it a better hold.

For the "*fournieren*" which Linderer resorted to in the case of deep cavities, he prepared rods made from the teeth of animals. He made the cavity circular, tapping the section to place with light blows of the mallet, or, after cutting a thread on the under part of it, screwed it into place. These inlays swelled in contact with the moisture of the mouth and perfectly sealed the cavity. Linderer relates that he had to meet with violent opposition among his colleagues, who often condemned his method without trying it. Thus B. Oenicke in 1847 condemned Linderer's method because "a boring out of the cavity would be necessary which would needlessly injure the defective tooth." Bruck, too, in his textbook on dentistry, finds this method "altogether inadmissible."

The results attained with "*plattieren*," and still more with "*fournieren*," were most excellent. The only reason why in time this method fell into disuse was the discoloration of the inlays, doubtless the result of the absorption of the débris of food.*

Three years after Linderer's publication of his methods, in 1837, glass was first actually used as a filling material. Dr. Murphy stated in London that he had used glass for the labial surfaces of front teeth by melting it upon a piece of platinum that exactly fitted the cavity. The inlay was secured in place with amalgam.

Probably the results reached were not very good, since many years passed without any improvements in this line of work. Not until 1857 was any progress made, when A. J. Volck published an article on "The Use of Porcelain in Filling Cavities in Front Teeth," in the *American Journal of Dental Science*. B. Wood followed in 1862, recommending the use of porcelain in pieces shaped to the cavity of decay. Marshall H. Webb states that the American, Hickman, made use, in 1870, of pieces of artificial porcelain crowns for filling buccal and crown cavities in molars. He was followed by E. T. A. Starr, who had such pieces of porcelain prepared of different shapes and provided with platinum pins. These pieces needed only a slight preparation of the edges to be ready for use.

A great step forward in the development of this method must be

*In 1891 Dr. Fenthol of Leipzig reported the use of ivory for inlays; he used it, like Linderer, in the form of rods.

ascribed to Dr. Land, of Detroit, who, in 1870, made the experiment of *fusing pieces of artificial teeth in a platinum impression of the outer borders of the cavity.* The high point of fusion of the material as well as the elaborateness of the process prevented the general adoption of this method.

In 1885 we hear of a new development through an article published by W. H. Rollins in the *Archives of Dentistry,* in which he describes a method of preparing porcelain fillings used by him since 1879. He shapes the walls of the cavity so that they stand perpendicular to its floor, and with a material composed of two parts mastic, one part paraffine and one part graphite takes an impression of the cavity, which has previously been painted over with vaseline. This is placed in a bath of sulphate of copper connected with a battery, and the plating with copper requires three days! He now removes by heat the impression material from the copper mould, which is about 1½ mm. thick, and bores a hole at the bottom of it. Into this mould he presses a piece of gold foil No. 30, with a ball of cotton, fills the gold foil with enamel powder, and fuses in a gas muffle furnace. Before the fused mass hardens it is pressed into the mould with a platinum instrument. After cooling, the enamel is removed from the mould by thrusting an instrument through the hole previously made, and the gold is drawn off from the piece. The fastening in place is effected with a mixture of zinc oxide and gutta percha, the excess which oozes out being removed with chloroform. This method approaches in many particulars that now in use, but is so tedious that it has not found general favor.

In some sort as a reply to Dr. Rollins, C. W. Dunn reported in the same year in the *British Journal of Dental Science* a method practiced successfully by himself since the year 1868, which had the advantage of greater simplicity. He took the impression with wax attached to a bit of sheet lead, made the model in plaster, which he then painted over with a mixture of wax and rosin to make the edges less friable, and ground to fit pieces of mineral or of natural teeth, sometimes using those of cattle or lambs.

In the year 1887 J. L. Stokes published in the *Southern Dental Journal* a method very similar to the above, the only variation being that he shaped the cavity of decay to the ground inlay. After insertion and the hardening of the cement, he followed the method already practiced in the seventies by Prof. Essig of Philadelphia, viz., removing the cement from the interstice at the edges and filling it with gold.

In 1889 W. Storer-How, in an article in the *Dental Cosmos,* described in minute detail the process, which is now tolerably well known, of making inlays by grinding pieces of artificial teeth.

In the same year, after several years of experiment, Wilhelm Herbst

put forth a new and much simplified method of making glass fillings. Having prepared the cavity without undercuts, he took the impression with Stent's Composition, made a model in plaster, removed the wax with boiling water, and filled the wet cavity of the model to about three-fourths of its capacity with powdered glass moistened with water. Then he absorbed the moisture from the glass with a bit of linen, dried the model, placed it on a piece of charcoal, and melted the mass with the clear flame of a Bunsen burner directed by the blowpipe. This melting was repeated with the addition of glass powder until the mass filled the cavity to the edges. In order to make the under surface of the filling rough, he placed grains of sand in the bottom of the cavity, which united without melting with the glass and furnished good retention.* Herbst's invention awakened much interest both in Germany and in foreign countries, and it is not to be denied that by the introduction of the glass filling he rendered great service to the development of the methods now used for porcelain fillings. Not only did there follow a great number of publications in the dental journals, but distinguished practical workers set themselves to improve and complete the process.

Thus in 1890 Prof. Sachs recommended taking the impression with Williams's gold foil and platinum foil No. 60, instead of Stent's Composition, and by means of this mould, obtained direct from the cavity itself, secured superior exactness at the margins. After Herbst, several others gave their attention to the production and use of glasslike substances for fillings, among them Schlitsky, Meyer, Reisert and Robert Richter. None of these glass preparations, however, have maintained their place in practice, for the following reasons: In the first place glass is not homogeneous, and the fillings are consequently porous and do not allow of grinding and polishing after insertion. Glass also changes color, owing to the lead to be found in most kinds of it, while it also crumbles at the edges. Consequently the hope that glass would prove to be for many cases pre-eminently a useful material has been disappointing.

There was now a return to the earlier practice of utilizing artificial teeth by grinding, and the inventions of means by which this difficult process is made practically useful was accomplished by the dentist Dali, of Glasgow, whose most excellent system will be described in a special division of this work.

Heitmüller, of Göttingen, also did much to promote the use of sections of artificial teeth in filling.

The want of a filling material which should be suited to remedy

*For this purpose Hartman puts dry plaster at the bottom of the gold impression, as it does not unite with the melting glass.

carious defects in teeth, without lacking the qualities of permanence and beauty, induced Dr. Jenkins, of Dresden, to make experiments in this line, which he began about the year 1891 and continued till 1898, the date of his first publication regarding his methods of filling. He has succeeded in inventing a combination and producing a substance which in many respects may be called "ideal." Apropos of the success which Dr. Jenkins has achieved with this fusible composition, it may be mentioned that the famous manufacturies of porcelain which flourish in the neighborhood of his residence gave him incentive and practical support in the production of his porcelain enamel.

After Jenkins had introduced his material to the profession, Dentist Moser, of Frankfurt, also came out with a porcelain preparation. It was claimed by the inventor that it had the advantage over the Jenkins enamel, which is a powder, of being furnished in small pieces which would ensure greater homogeneousness on melting. In my opinion, however, it is just this form of the Moser composition which makes it objectionable, since by using the Jenkins powder the melting mass can be easily directed to every part of the mould and the exact quantity needed can be applied, while in the use of pieces the flow of the melting mass is a matter of chance, and the resulting height of the filling is uncertain. Nor does the manner of working Moser's material, which is melted over a Bunsen burner without investment, easily admit of a correction of the contour. However, in certain cases this substance, which in composition is much like that of Jenkins, can be used with good results.

Following Moser, Dentist Glogau invented a preparation called "Kaolith," which he believed to be far superior to the Jenkins porcelain enamel, but it does not entirely fulfil the expectations which its discoverer entertained for it.

The coloring matter of fillings made of this material is a pulverized enamel, which is melted upon the floor of the impression and gives the required color by shining through the stratum of Kaolith that is made to flow over it. It frequently happens that the powdered enamel does not confine itself to the base of the filling, but mixes with the general mass. Moreover, the finished filling has the disadvantage of a glassy lustre, rather than a uniform shade of color.

Dr. Jenkins has certainly rendered operative dentistry a great service. At all events, his porcelain enamel has been crowned with the highest success. As his discovery was made in Germany, it naturally awakened the greatest interest among German dentists, which is shown by the fact that there is scarcely a dental meeting in which either a paper treating of the Jenkins System or a demonstration is not on the programme.

With few exceptions reports on the use of the Jenkins method have

been most favorable. It is natural that in judging of an innovation of this kind mischances that are unavoidable in the beginning should make a great impression. Discouraged by such causes, many give up further trials as useless and become opponents of a system which, pursued with patience and persistence, is destined to be of immense value in practice.

Being of the opinion that one ought not under any circumstances to exclude from examination any improvements that seem to have actual value, I have tested all the glass and porcelain preparations obtainable, and have come to the conclusion that there is no other material with which we can make better porcelain fillings than with the Jenkins porcelain enamel.

Not only in Germany, but also in America, has this method received deserved attention, and its invaluable qualities are being recognized there. At a meeting of the New York Odontological Society, the President, Dr. S. G. Perry, said: "We are standing at the beginning of a new era of great significance. The time appears to be approaching when gold fillings in front teeth will be regarded as a relic of a forgotten and barbaric age."

It is not impossible that a better substance than this may come into use; yet I think that for a probably long period we shall find in porcelain enamel a material not to be surpassed; a material by means of which we can render both our patients and ourselves distinguished and satisfactory service.

I.

Indication and Contra-indication of Porcelain Fillings.

The position of teeth in the mouth, the quality of tooth structure, and the size of the cavity of decay are the conditions upon which the adaptability of porcelain fillings depends.

Moreover, it is wise for such as have but recently begun to practice this method to let the choice be governed by the extent of proficiency already acquired. If one has not yet become thoroughly familiar with the preparation of cavities, the taking of impressions and the melting process, it is better to confine oneself in the use of porcelain to labial and cervical cavities and cuneiform defects.

For such cavities we always prefer a material which restores as far as possible the original appearance. The taking of impressions from these accessible cavities is comparatively easy, and the melting does not make excessive demands on the operator.

But before one proceeds to fill teeth for patients he should acquire facility by experiments out of the mouth, *since just in the proportion*

that a successful filling of this kind contributes to the preservation of the tooth, in just that proportion does a filling fail of doing so if it is in any respect imperfect.

The employment of porcelain fillings has the great advantage over the use of other materials that it is seldom followed by secondary decay. *Even those who have entirely mastered this method should use their best discretion in the choice of cases.*

As I have already mentioned, porcelain fillings are *indicated:*

(1) For labial cavities.

(2) For cervical cavities and cuneiform defects.

(3) For buccal cavities in molars.

(4) For all approximal cavities where the piece to be inserted will not upon occlusion be touched by the antagonizing tooth.

(5) For large defects caused by caries or fracture.

As above noted, the restoration with porcelain of defects cited in 1, 2 and 3 is desirable on account of the conspicuousness of the positions, where we should aim to avoid attracting attention to the repair.

Buccal cavities in molars which often extend *under the gum margin,* are suited to this method, because by its aid we can make a better joint than with any other material.

For approximal cavities in incisors, cuspids and bicuspids, porcelain is always to be preferred on æsthetic grounds in cases where the position and play of the lips make these teeth visible in speaking, so that the gold or amalgam fillings would appear unsightly. Further, porcelain fillings are to be recommended for all cases of extensive decay where enough of the tooth is left to give a strong attachment and an entire crown is not absolutely required.

Porcelain fillings are *contraindicated:*

(1) For crown cavities in bicuspids and molars where severe usage in masticating may readily occasion fracture.

(2) For approximal cavities where the force of mastication is likely to dislodge the filling.

(3) In all those smaller visible cavities where gold is not strikingly noticeable.

(4) For small circular cavities which can be more readily filled by using Dall's prepared inlays.

(5) For those shallow cavities where sufficient depth cannot be secured without too great sacrifice of sound dentine.

(6) In the case of all cavities where it is impossible to get a perfect impression.

From the examples given we learn to what cases this method applies and to what others it is unsuited. In any case it is better to judge care-

fully beforehand than to discover a mistake only on the completion of the filling.

Especially would I discourage any blind, excessive application of this method. Porcelain inlay work requires no less skill and persistence than filling with gold, and there are many cases where a gold filling guarantees a surer success. Particularly is one tempted at first, having been successful with a few fillings, to throw overboard the old ways because of admiration for the new. That is indeed a great mistake, which can only lead to disaster.

By using the greatest possible deliberation as to the cases in which one may employ porcelain to real advantage, one will learn to save time and labor and to avoid those unhappy failures which tend to bring the method into disfavor with the public.

In the preparation and insertion of porcelain fillings the dentist should subject himself to the *severest self-criticism* and be content only with *absolutely perfect fillings, since any filling of whatever material is to be preferred to a porcelain filling which is not in every respect excellent.*

II.

The Preparation of the Cavity.

In porcelain inlay work the preparation of the cavity is of the utmost importance. There are three rules which must be observed under all circumstances, viz.:

I. The cavity must be prepared *without undercuts.*

II. *The margins must be sharply defined, strong and perfectly smooth, but not beveled.*

III. *The cavity must not be so shallow that the filling cannot be secured in place.*

The neglect of *even one* of these precautions absolutely excludes the possibility of success. It is impossible to promote the preservation of the tooth in the smallest degree with an imperfect porcelain filling, while with a perfect one we can prolong the life of a carious tooth and essentially heighten its functional capacity.

As mentioned previously, almost all cavities are suited to receive porcelain fillings, but I will enumerate here once more such as are to be considered, that I may describe their preparation in due order.

The simpler cases are those presenting on:

(1) Labial surfaces of incisors and cuspids.

(2) Cervical surfaces and in wedge shaped defects amounting to deformity.

(3) Buccal surfaces of molars.

More difficult are those occurring on:

(4) Approximal surfaces of incisors and cuspids.

(5) Approximal surfaces of bicuspids and molars.

(6) Where fracture or caries has caused great loss of substance in front teeth.

In the cases scheduled in 1, 2 and 3, we excavate thoroughly and deepen the cavity, taking care not to injure the pulp. When it is not possible to obtain sufficient depth by removing the carious dentine without disturbing the pulp, we resort to a slight hollowing out either in the direction of the neck or of the cutting edge (avoiding undercut!) which will give the filling a good hold (Figs. 1 and 2).

It is better to devitalize exposed pulps than to cap them. After removal of the dead pulp, this hollowing out is of course not necessary,

Fig. 1.

Fig. 2.

for we can then deepen the cavity to our liking and ensure a firm hold. It is better to use rose burs adapted to the size of the cavity. With the larger ones we can almost completely give the right shape to a large cavity.

Owing to their favoring position cavities 1, 2 and 3 are more easily prepared than those on the approximal surfaces of incisors, cuspids, bicuspids and molars.

Separation of the Teeth.

In these latter cases it will generally be necessary to separate the teeth in order to get a good impression, which is best done before beginning the excavation, as one thereby gets a better view of all parts of the cavity; therefore a few words here as to separation.

The relatively simplest means of securing sufficient interproximal space is the wedging of absorbent cotton between the teeth and letting it

remain a day or two. Press into the space a dry piece and follow it with one dipped in mastic. The dry piece will swell on absorbing moisture, while the mastic will prevent the wedge from falling out.

This way of separation has the disadvantage that it must sometimes be repeated, which requires time not always at command in the case of patients coming from a distance, and also that patients are annoyed by the soreness occasioned by prolonged pressure.

Therefore it is better when practicable to undertake immediate separation.

This is to be accomplished by the customary filing with separating files (Fig. 3). In order not to sacrifice more of the enamel than is abso-

Fig. 3.

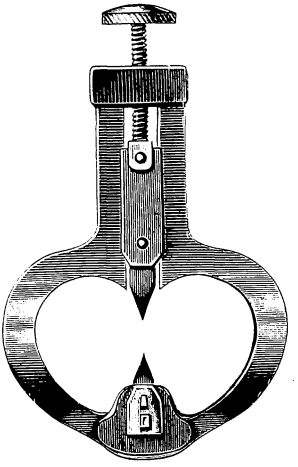


Fig. 4.

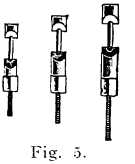


Fig. 5.

lutely necessary, we employ, after using the lowest number of file (000-0), some of the many separators, of which the Ivory and the so-called "Little Giant" may be noted.

Ivory's separator (Fig. 4) consists of two wedge shaped spurs filed to a point, one of which is fastened to a small hoop, while the other is attached to a screw, which being turned pushes this movable wedge towards the fixed one. The stationary spur is placed at the approximal space on the palatal or lingual side of the teeth; the movable one on the labial or buccal. As the wedges are made to approach each other by slow turning of the screw, the space between the teeth constantly increases. On the first introduction of this instrument we should only screw the wedges towards each other sufficiently to hold it in place and afterwards

proceed by slow stages, since the pressure is unpleasant for the patient and too quick or violent wedging may occasion periostitis. It is a pity that this separator is made in one size only, which does not apply to all cases. The spurs should have differing shapes and be interchangeable.

Fig. 6.

The "Little Giant" separator, which is to be had in three different sizes (Fig. 5), consists of a fine threaded screw, at one end of which a wedge is fastened, with a second of similar shape sliding upon it and moved by means of a nut, which is turned up with a key (Fig. 6), thus pushing the two points together. The principle of this device, like that of the Ivory, is pressure from two wedges approaching each other. Fig. 7 shows the instrument in position.

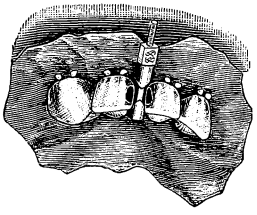


Fig. 7.

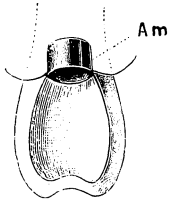


Fig. 9.

Fig. 8.

Wedging with wood is unpleasant for the patient, yet is to be recommended for many cases, that is to say, when the space to be gained is small. The sharpened hickorywood* should be spear shaped (Fig. 8). Drive in with light taps of the mallet or by hand pressure as far as (*a*) of the spearhead. The wedge should remain in position without slipping until the operation is completed. Improperly shaped wedges will loosen and fall out.

In most cases that present themselves some one of these methods will suffice; but in cavities that extend under the gum the use of cotton as above described is imperative in order to force the gum which intrudes upon the cavity as much as possible away from the tooth.

*The orangewood of the depots is unsuited to this purpose because it is often pithy inside.

In Fig. 9 I present a method which I practice now and then of placing an underlay of amalgam at the bottom of cavities that extend very far under the gum. This essentially facilitates the taking of the impression.

Approximal Cavities.

We may now take up the preparation of approximal cavities. If the labial, palatal or lingual wall of a cavity be especially weak; if, as often occurs, there is only a stratum of enamel, it should be removed

Fig. 10.

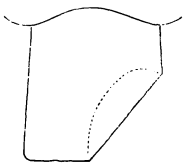


Fig. 11.

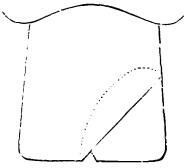


Fig. 12.

Fig. 13.

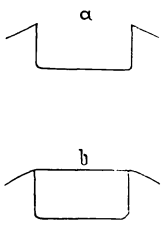


Fig. 14.

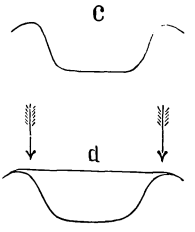


Fig. 15.

with an enamel chisel, since it is easily fractured, and the success of the filling is only apparent. In any case one should provide broad access to approximal cavities, for weak walls can be most effectually restored by a porcelain filling. As before remarked, teeth which have suffered great loss of substance can often be strengthened and made useful by this new agency. In Fig. 10, I illustrate the preparation of an approximal cavity

in a bicuspid; *a* shows the mesial surface attacked by caries, *b* the excavated cavity which extends to the fissure, *c* the shape of the cavity at the coronal edge.

When one has secured the space necessary for the withdrawal of the impression, and completely removed the weak walls and softened dentine, he begins with the special preparation of the cavity.

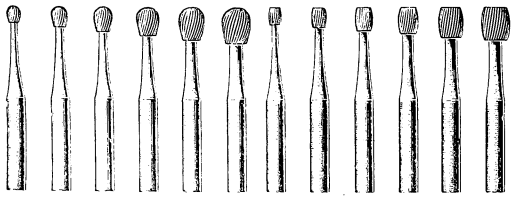


Fig. 16.

The hollowing out, represented in Fig. 11, is also to be recommended for approximal cases. It is better in such instances to make it near the cervical edge, though a weakening of the wall is of course to be avoided. If the loss of tooth structure in an incisor is so great as to include a portion of the biting edge, as shown in Fig. 11, there is one important item which in excavating we must not leave out of our reckoning. If we

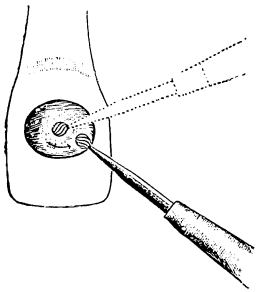


Fig. 17.

give the cavity the shape indicated by the dotted line, the frail corner of the inserted filling at the biting edge will break away in a short time and present the appearance shown in Fig. 12. We must seek to prevent this by cutting a semi-circular groove on this edge, as in Fig. 13; by this means such an accident is rendered impossible.

For the preparation of cavities where great loss of substance does not permit of a prescribed rule, we must of course treat each case differently, observing all established points of procedure. Some such cases are described in the last chapter of this division.

The shape which the operator must give to all the cavities above mentioned is that of a trough. One should avoid a perfectly round shape, since thereby the trial and final setting of the inlay is made more difficult. Altogether the most important part of the preparation is the finishing of the margins. I have set forth as the second rule of importance that they should be sharply defined, strong and perfectly smooth, but not beveled. What I intend by this is made clear by Fig. 14a and b, and 15c and d. While 14a represents the section of a properly pre-

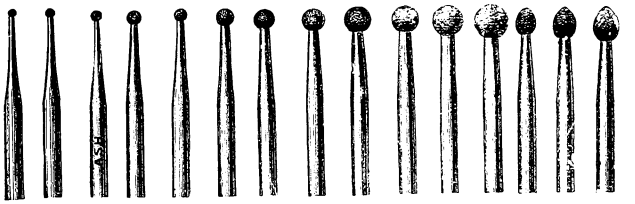


Fig. 19.

pared cavity whose margins are sharp and show no bevel, Fig. 15c gives the section of one improperly prepared. The margins in 14a are sharp, those in 15c rounded off. If we put a filling in the properly shaped cavity 14b, an injury under stress of mastication is not likely to occur. But if as in Fig. 15d thin portions of the filling overlap the edges, they will split off at the points indicated by the arrows.

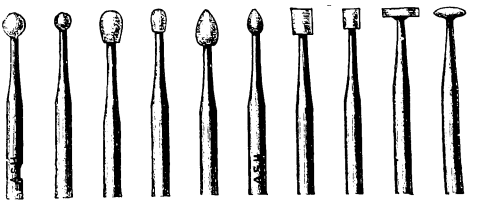


Fig. 20.

For grinding and polishing the margins we use pear shaped, barrel shaped and round finishing burs (Fig. 16). We must confine their use, however, to the inner walls of the cavity, never allowing them to slip over the margins (Fig. 17), or we shall bring about the wrong condition censured in Fig. 15c.

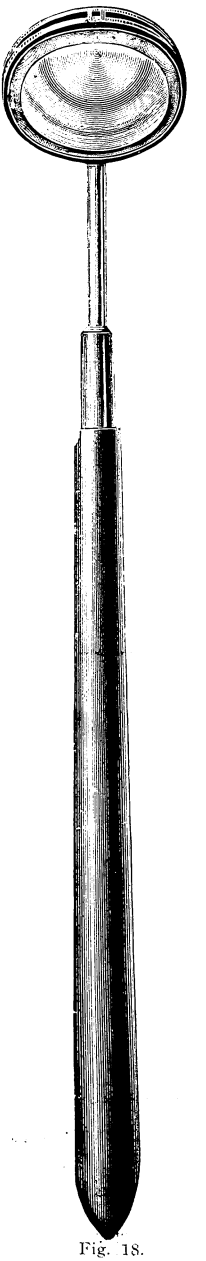


Fig. 18.

If we examine with a lens (Fig. 18) a cavity prepared in conformity to the conditions, the edges which seem smooth to the naked eye will exhibit many inequalities. To remove these we use pear shaped and round finishing burs coated with diamond dust (Fig. 19). More recently the small Arkansas stone points suggested by Dr. Jenkins have come into favor for this purpose (Fig. 20).

Only by closely following *all* the directions given in this division shall we be able to obtain faultless impressions from the prepared cavity and with these reach good results in porcelain filling.

III.

Taking Impressions.

As I have taken frequent occasion to emphasize the fact that in order to obtain satisfactory results especial care must be taken in the preparation of cavities, so at once I wish to point out that the getting a good impression is of equal importance to the success of porcelain fillings.

Unless the impression be perfect it is impossible that the filling should serve in the least degree to preserve the tooth.

It cannot therefore be too often emphasized that taking the impression is at the same time the most important and the most difficult part of the procedure. Not until by continued practice one has acquired great skill in taking impressions of all sorts is he qualified to use this method with success. This or that difficulty which one meets at the beginning he must learn with patience to surmount, since it is only by the study of failures that we learn to avoid them.

Rubber Dam. Whenever the situation of the cavity renders it possible it is advisable in taking an impression to adjust the rubber dum. For example, in labial cavities in the front teeth, where the Ivory clamp holds the dam well away from the field of operation. The two neighboring teeth must also be included in the isolation, in order that the rubber may not interfere with the gold foil of the impression and perhaps alter its position.

Should it be impossible to use the rubber dam and clamp—if, for instance, the cavity extends beneath the gum, there remain two methods of procedure by means of which we may keep the region perfectly dry.

Dental Napkins. The napkins, of linen, about 20 cm. square, should be folded triangularly. For cavities in the front teeth the point of the triangle will be placed under the lip (Fig. 22); in the case of cavities farther back in the mouth, pressed against the cheek, and, as shown in Figs. 22, 23, will be held in

place against the alveolar process by the lip or cheek and the help of a finger. The broader portion of the napkin may be pushed into the mouth to form for a time an effectual protection against saliva.

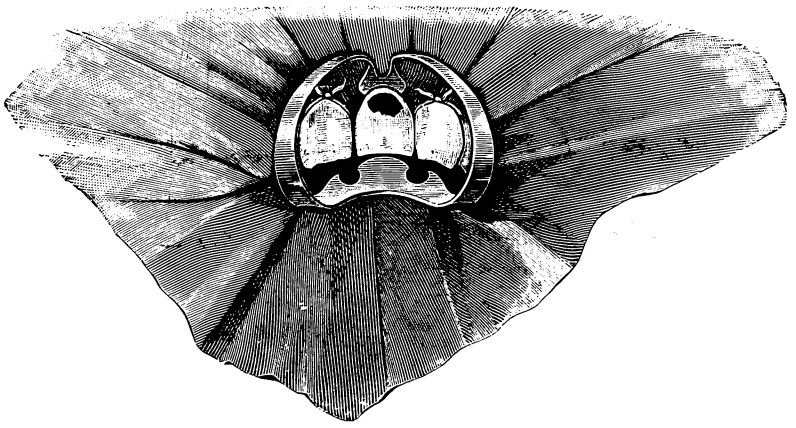


Fig. 21.

Saliva Clamp. This is an instrument which I constructed several years ago for use in crown and bridgework and also in other cases not admitting the use of the rubber dam, to avoid disturbance from the flow of saliva. It is made in two

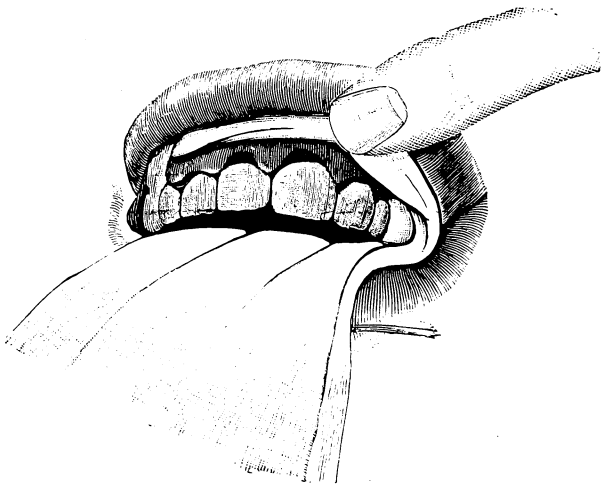


Fig. 22.

forms, one for use on the right and one for the left side, and serves to exclude during the operation the flow from the parotid gland through the duct of Steno. As seen in Fig. 24, this instrument is in the form of a

pair of scissors, one arm of which ends in a flat ball designed to cover the duct of Steno, while the other is shaped as a ring that presses against the

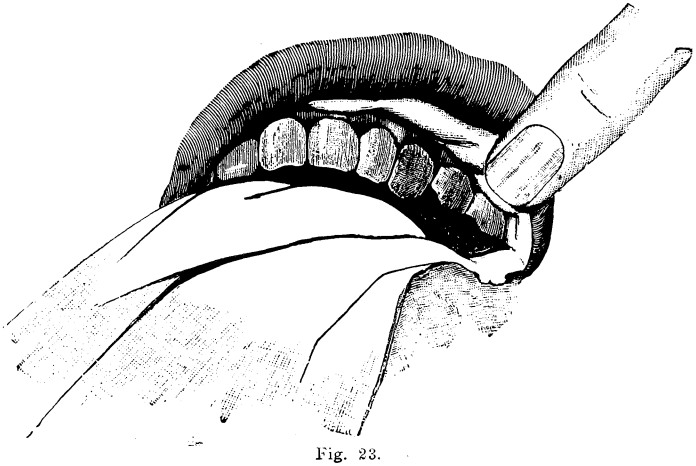


Fig. 23.

outside of the cheek. The two arms are held together by a spring attached quite sufficient to fix the instruments to the handles. Light pressure is in place, and in the case of sensitive patients cotton can be placed over the ends. As I have already made clear in the September, 1900, number of the *Deutschen Monatschrift für Zahnheilkunde,* in which I described this device, no evil consequences from this confinement of the saliva have been observed. Fig. 25 shows the instrument in position.

The Harvard Clamp.

For excluding saliva I have also used the Harvard clamp (Fig. 20) in many cases, applying it to one of the adjoining teeth. By means of the two arms which carry absorbent cotton rolls we can keep the field of operation a long time free from saliva. This clamp is made for bicuspids and molars.

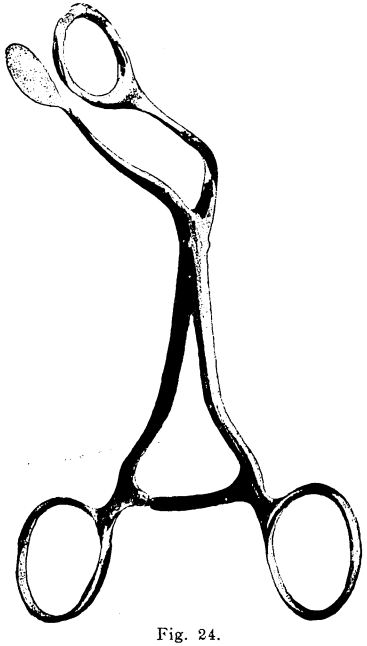


Fig. 24.

Taking the Impression.

After the tooth and neighboring parts have been dried, the tooth should be painted over with some fatty substance, in order to make the withdrawal of the goldfoil impression easier. Jenkins uses vaseline for this purpose. I have used with the best results fine olive oil applied thinly with a brush.

Fig. 25.

Various aids have been presented to render the taking of impressions easier. It has been proposed to take first an impression of the cavity with Stents's Composition or wax, prepare a model, and then press the gold foil into the mould. There has been a special swaging apparatus made for this purpose, but none of these aids are suited to give up such an impression as we can obtain by following the method which I am about to describe, and which ensures a representation of the cavity which is in all respects accurate.

I mention first the invention of Dentist Bruhn, of Düsseldorf, who has devised Trial Dies by which the goldfoil may be given a shape approaching that required before it is pressed into the cavity. The apparatus consists of a rubber cushion upon which the goldfoil is laid. We then select from the assortment of twenty-five stamped pieces of metal that which comes nearest in shape to the cavity to be filled, screw it upon a handle and press the stamp, as shown in Fig. 27, lightly upon the gold on the rubber cushion. The superfluity of goldfoil which might be in the way of taking or withdrawing the impression may then be cut away with scissors. I am convinced that this apparatus could render good ser-

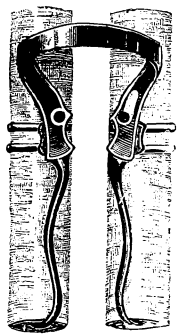


Fig. 26.

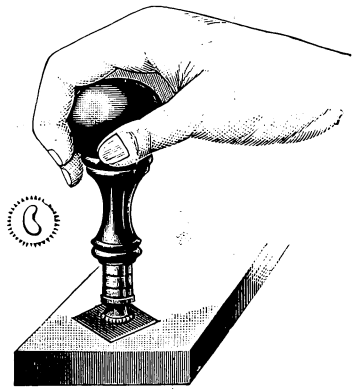


Fig. 27.

vice to beginners. For the skillful it is not necessary. As I have already said, by continued practice one may acquire great skill in the manipulation necessary to take impressions, though at first the difficulties seem great.*

We attain the end arrived at with Bruhn's Trial Dies in a manner much simpler by shaping the goldfoil to the required form while held in the hand (Fig. 29) with a pear shaped instrument (Fig. 28).

The goldfoil Nos. 30 and 40, used for impressions, may be kept on hand cut to various sizes, thus avoiding loss of time in this time-consuming work. The foil most to be recommended for this purpose is that of Williams or White. Williams's is somewhat tougher and does not tear so easily. Beware of using foil to which particles of Paris red used for

*Another apparatus similar to Bruhn's has recently been constructed, which includes a number of circular knives for cutting out round pieces of goldfoil. The high price of this apparatus will probably prevent its coming into general use, especially in view of the fact already stated that it becomes superfluous on the acquirement of greater skill.

polishing still cling. Fillings melted in such foil often take on a reddish tinge, especially at the edges, which may destroy the success of the filling.

For smaller cavities the thinner foil, for larger the thicker is recommended. Various materials may be used for pressing the foil against the walls of the cavity, for example, cotton, soft erasing rubber, unvulcanized caoutchouc, soft chamois leather and spunk; for the most part I use spunk, cut to various sizes, and sometimes small round pieces of chamois leather cut out with a punch (Fig. 30).

Fig. 28.

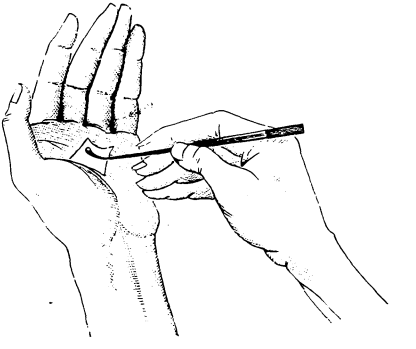


Fig. 29.

Fig. 30.

Place the already partly moulded piece of foil in the cavity with the pliers and hold it steady upon the deepest part with a piece of spunk.*

To beginners we especially recommend that in taking difficult impressions they make sure by the removal of the first piece of spunk that the gold is so placed that the edges will not be drawn into the cavity by the pieces subsequently introduced. This will surely happen if the foil has been cut too small or if it be not properly laid in the cavity. *During the whole time of taking the impression one holds in place with a blunt instru-*

*In cutting up the spunk reject all but the softest pieces. For taking impressions only the softer sorts should be used; a hard piece may render the impression unfit for use.

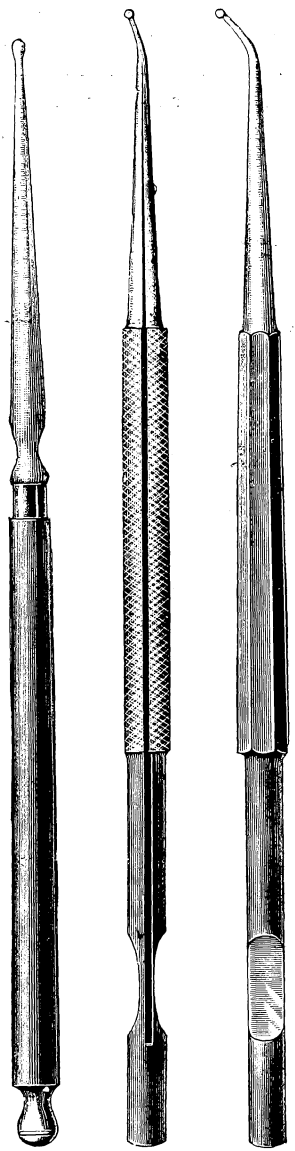


Fig. 31. Fig. 32. Fig 33.

ment, held in the left hand (Fig. 31), *the pieces of spunk already placed in the cavity,* taking constant care that the foil does not lie pressed upon the edges of the cavity, which would certainly result in its being torn. For putting in the pieces one may use any pliers not too pointed unless one chooses to get those made for this purpose by Dr. Keyes (seen in Fig. 32 from the front and in Fig. 33 from the side), which is provided with buttons that form a small ball when the instrument is closed and which prevent piercing the goldfoil.

Continue to fill the cavity with spunk without exerting much pressure

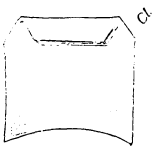


Fig. 34.

near the edges. When the cavity extends far under the gum and especially in approximal cavities it is well to cut the goldfoil in the shape given in Fig. 34, bending the upper edge *a* and laying a piece of soft chamois leather in the bent edge and placing them together between the teeth (Fig. 35). This will prevent the goldfoil from being drawn into the cavity. Now take away the chamois skin to convince yourself that the goldfoil is in the right position and proceed to fill with spunk as above described. When the cavity is full the next step is to press the overlapping goldfoil upon the edges of the cavity. On this point I would remark that *it is of great importance for the melting to retain as much as possible of the foil in order to have during the melting a good idea of the situa-*

tion of the cavity in the tooth. However there must not be retained so broad a margin of foil as to interfere with the removal of the impression from the cavity. For compressing the foil over the edges, which is not to be done until it has been closely pressed against the interior walls by filling the cavity with spunk, I have constructed six instruments which are sufficiently adapted to the requirements of every cavity.

The cuts give both front and side views of these instruments. That in Fig. 37 is intended for all large labial cavities; 38 for smaller labial cavities; 39 and 40 for approximal cavities; 41 for cervical cavities; 42 for pressing the foil into fissures of bicuspids and molars.

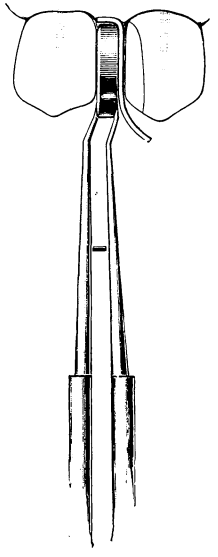


Fig. 35.

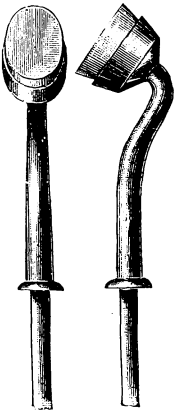


Fig 36.

These instruments are to be used with a light rocking movement, beginning at the edges of the cavity, until the goldfoil is pressed smoothly upon the tooth. Fig. 43 shows the use of these instruments in taking an impression of an approximal cavity in a bicuspid. The two instruments marked *a* and *b* have pressed the foil against the palatal and buccal walls; the instrument *c* presses it into the fissure of the tooth.

We now begin the removal of the spunk. With a pair of sharp pliers we take out one piece after another, those remaining in the cavity being still held firmly with an instrument. If in spite of using these instruments

there is any point where the goldfoil does not lie close to the tooth, which may sometimes occur near the cervical edge, we must go over this portion either with the ball pliers or with the ball burnisher (Fig. 45), holding the foil meanwhile with a blunt instrument at some other part of the cavity (Fig. 31). For an impres-

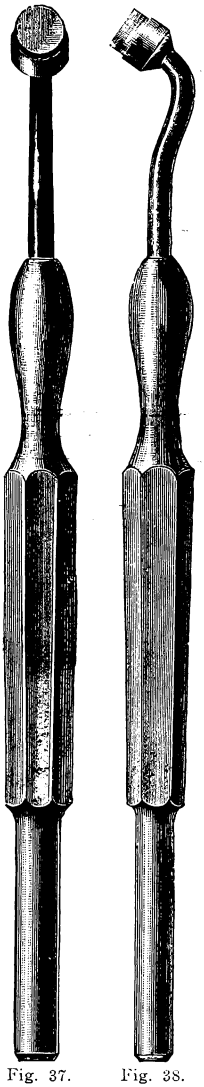


Fig. 37. Fig. 38.

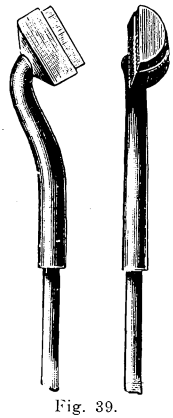


Fig. 39.

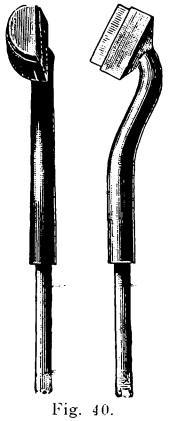


Fig. 40.

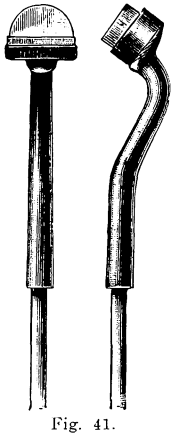


Fig. 41.

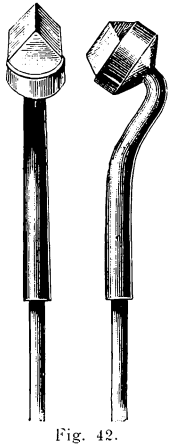


Fig. 42.

sion of a cervical or labial cavity it is sufficient to press with one of the instruments upon the spunk which fills the cavity. The foil is pressed down upon the margins by the elastic rubber, so that further manipulation will be superfluous. If it happens, especially in approximal cavities, that

the foil is too large at the cervical edge, or that in the case of front teeth it extends too far over the palatal wall, so that it would be difficult to remove the impression without bending it, we cut away the superfluous part with a lancet or excavator, taking care to keep the impression in place by holding it with a blunt instrument.

Fig. 45.

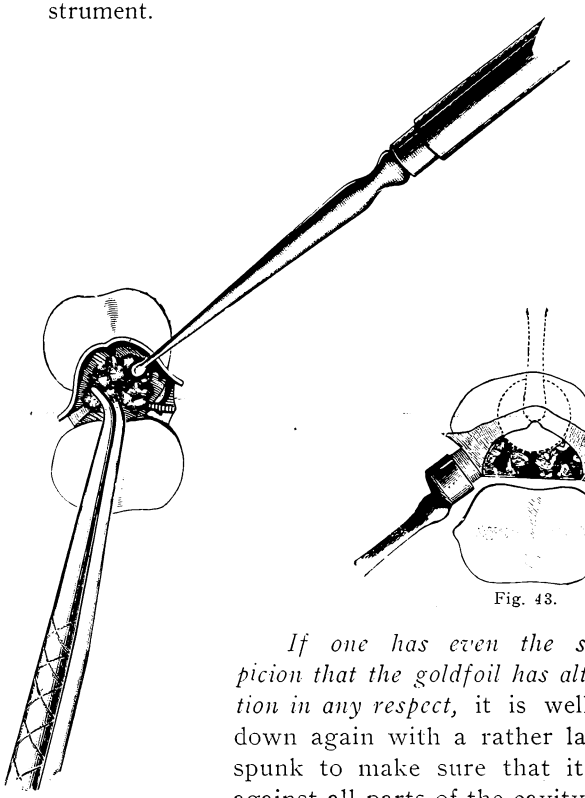


Fig. 44.

Fig. 43.

If one has even the slightest suspicion that the goldfoil has altered its position in any respect, it is well to press it down again with a rather large piece of spunk to make sure that it lies closely against all parts of the cavity. Many recommend taking several impressions of every cavity and the melting of several fillings. Doubtless this is of great value to the beginner, since by this means he obtains a degree of skill in taking impressions and in melting. When, however, one is so far advanced as to succeed with almost every impression, this is unnecessary. Of course it will sometimes occur when the cavity is difficult of access that the first filling may not fit as perfectly as desired, but the repetition of the process in such a case will not consume so much time as that required for several impressions and meltings for each case.

Removal of the Impression.

Before removing the impression examine carefully with the lens to make sure that the foil is lying closely upon all the edges of the cavity.

To loosen the foil I have for a long time made use of an instrument that suits all cases. It is White's excavator No. 97 (Fig. 46). In labial cavities I place the point at the deepest point of the impression, when a light lifting movement is usually enough to remove

Fig. 46.

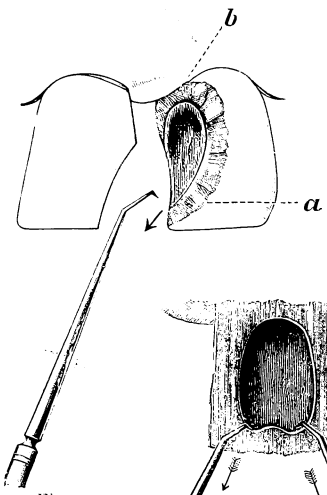


Fig. 47.

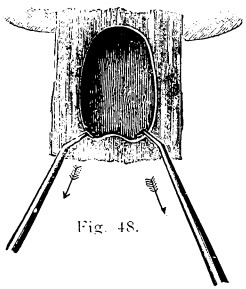


Fig. 48.

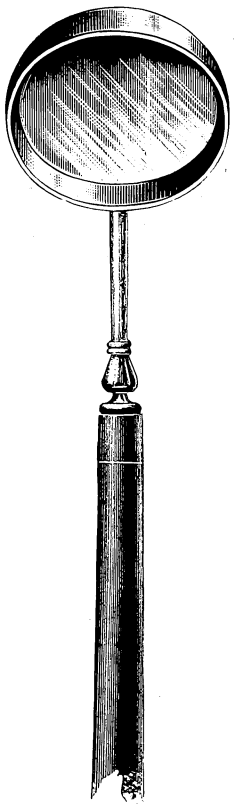


Fig. 49.

it. In approximal cavities in the front teeth (Fig. 47) I place the point of the excavator at the place marked *a* and try to draw out the impression by a downward motion, as indicated by the arrow; should the foil not loosen at the first attempt, I continue by carefully inserting the instrument between tooth and foil, beginning at the point *b,* until the loosened condition permits withdrawal without difficulty. From approximal cavities of molars and bicuspids I loosen the impression both on buccal and palatal sides (Fig. 48). The removal of the foil is very difficult only in cases where the cavity has not been properly prepared; with patience we soon learn what to avoid in order to effect the removal easily and without bending the foil anywhere.

The method proposed by Robicsek, of blowing the impression out of the cavity with the airblower, is not to be recommended on account of the uncertainty as to where the impression may light and the danger of its being bent.

If rents in the goldfoil are present after removal from the cavity, they will not affect the result *if they do not reach too near the edges.* However, it is well to aim at removing the impression uninjured, since rents in the foil, wherever situated, make bending more possible and require more careful attention during the fusing process.

The best implement for receiving the impression is the mouth mirror having a high rim, as devised by Prof. Sachs (Fig. 49). If one does not proceed immediately to the melting, the celluloid boxes now everywhere to be obtained are useful to protect the impression from injury.

Choice of Color. The color assortment of Dr. Jenkins, selected from many hundred shades actually tested by him, should suffice for all cases, but if any other shade be desired, it can be obtained by mixing the powders furnished.

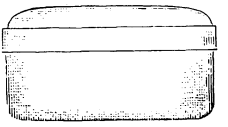


Fig. 50.

In regard to obtaining good results in color, I would emphasize one piece of advice that I have already given in my article on "The New Porcelain Enamel of Dr. Jenkins," which appeared in 1898, viz.: to remove the color patterns from the color fans and to replace them by patterns made by oneself, giving each sample a fourfold fusing. The influence of the varying heat of different furnaces upon the color of the material differs so much that this precaution is much to be recommended.

In selecting colors take for all labial cavities that which comes nearer to matching the tooth; for all approximal cavities choose a somewhat lighter shade. When I come to speak of the insertion of the filling I shall take occasion to show what modification of the color is then possible in case that the inlay does not exactly match the tooth. After matching the color *while the tooth is wet,* if the filling is not to be inserted at the same sitting, fill the cavity with gutta-percha, first removing the vaseline or olive oil with carbolized alcohol.

In melting contour fillings it is advisable to have the desired form constantly before the eyes. Therefore either take an impression of the

cavity in Stent's compound, make from it a model in fine plaster, or model the contour of the tooth with gutta-percha, harden with cold water and remove. While melting the filling, keep this model before the eyes to show how to build up the powder in order to perfect the contour.

Taking Impression, Dr. Sachs's Method.

At the meeting of the Central Union, held at Easter, 1901, Dr. Sachs described a process of obtaining a good impression of teeth having defects of contour which I should not leave unmentioned. Dr. Sachs remarked that the difficulty in the case of such teeth was not so much in getting good impressions as in building out the porcelain—usually for missing corners—to the proper shape. Even when one is skillful the tooth may not receive the proper slant, and it is difficult to give the corner a perfectly natural look, if the work is guided only by the judgment of the eye. It is therefore desirable to secure beforehand a means of producing accurately the desired form. Warming a piece of Stent's compound the size of a walnut, he presses it from the palatal side upon the tooth, the cavity and defective part, lets it cool, and then cuts away from the Stent's compound until only so much is left as represents the portion of the tooth that is to be replaced by porcelain. Then he takes an impression with goldfoil, paints the Stent's compound model over with vaseline and presses it with the foil into the cavity so that the goldfoil outside the cavity lies closely against the Stent's compound. The Stent's compound is then removed, leaving the goldfoil in place, which is easily done, as the vaseline prevents adhesion. He now fills the hollow in the foil with wax in order to prevent bending the goldfoil on removal, invests in a mixture of plaster and asbestos, washes out the wax and, putting porcelain powder in its place, proceeds with the melting.

IV.

Investment of the Impression and the Melting Process.

I will now speak of the apparatus used in the preparation of porcelain fillings. Since cleanliness during the melting process is a chief requisite, it is advisable to have a special table reserved for porcelain work, which should be covered with sheet tin or iron and upon which all the necessary instruments and apparatus may be always ready for use. The bottles which hold the powder must be kept closed against dust; the spatula and brushes used for putting the mixed powder into the impression must always be carefully cleaned before using. In the middle of my work table I have an electric furnace upon a stand just high enough to bring the opening of the furnace on a level with the eyes. There is also a hermetically closed vessel containing asbestos powder mixed with alco-

hol; a bottle of alcohol having a droptube, a number of plates upon which to mix the powders; pliers, spatula and brush; several footless wineglasses for covering the remnants of powder after the melting, a pair of colored glasses to shield the eyes from the glow of the furnace, and the box of powders.

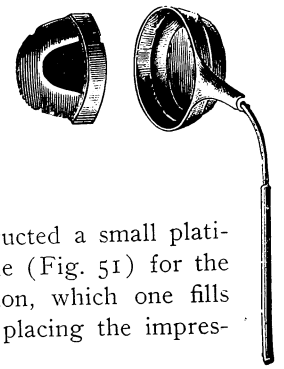


Fig. 51.

Investing the Matrix.

Dr. Jenkins has constructed a small platinum cup with a long handle (Fig. 51) for the imbedding of the impression, which one fills with the asbestos mixture, placing the impression in it with the pliers.

I do not mix the asbestos with water, as Dr. Jenkins recommends, but with alcohol; for it is my experience that unless the greatest care is observed in the drying process the conversion of the water into steam causes the lifting up of the goldfoil, and the impression obtained with so much painstaking is bent and spoiled.

One must take care in imbedding the impression that the under side next to the asbestos be everywhere supported by the paste, which may be usually brought about by gently tapping the cup on the table, but in many cases, especially in complicated approximal filings, we must draw some of the paste from the edge of the cup with a spatula (Fig. 52), pushing it under the impression until sure that all hollow places are filled. There is another small aid which we may not despise, since such are often very important for the final success of the filling. In most cases sufficient goldfoil has been retained to show clearly the shape of the tooth and the surrounding parts. The superfluous goldfoil having been pressed closely against the tooth pictures the situation of the cavity. We should imbed the matrix in such a manner that, as far as possible, we may have the cavity before the eye in the melting cup in the same relative position that it occupies in the tooth; we shall thus in most cases avoid putting in too much powder. Fig. 53 shows the prepared cavity. In Fig. 54 the foil lies over the edges in such a way that it may be easily removed and will give an almost perfect representation of the tooth. In Fig. 55 the position of the cavity and the shape of the tooth can easily be recognized from the imbedded gold.

When the impression is properly placed in the asbestos, ignite the alcohol contained in the asbestos paste and let it burn away completely. It will often happen that some of the paste has flowed

into the impression, perhaps through a rent at the bottom, and dried on by the burning out of the alcohol. It can best be removed by a brush wet with alcohol.

Filling the Matrix.

Place the probable quantity of porcelain powder required for the filling upon the agate plate furnished with the Jenkins apparatus and mix with absolute alcohol to a thin paste of cream-like consistency.*

In mixing the porcelain powder with alcohol take great care that it be kept free from dust, threads or other impurities, since the smallest particles of dust may affect unfavorably the color of the filling. After moistening the foil with a drop of alcohol, fill the impression to the edge with the porcelain paste, which may be done with the spatula recommended by Dr. Jenkins, or, as I prefer after long experience, with a very small, finely pointed camel's hair brush. If the alcohol evaporates before the impression is filled, moisten the paste again.

Fig. 52.

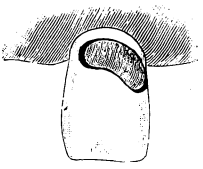


Fig. 53.

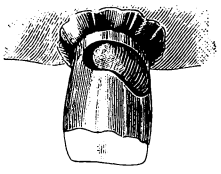


Fig. 54.

The important point in filling the impression is that the paste should fill it perfectly everywhere, so that there be no hollow places beneath which can cause bubbles in the melting. We make sure of this by letting alcohol drop into the impression from the droptube held in the left hand, while with a brush in the right hand we gently manipulate the paste until it is thoroughly distributed to every part (Fig. 56). We are also careful *not to put too much paste at a time into the impression.* The asbestos, as well as the porcelain powder, should now be dried by burning out the alcohol before the fusing process begins.

The Furnaces.

For this process Dr. Jenkins has constructed two similar pieces of apparatus, one for gas and the other for alcohol, this latter for the use of those who have not at command either gas or electricity. With the introduction of the

*Dr. Jenkins strongly advises against mixing porcelain-enamel with alcohol on glass, lest particles of glass become mixed with the powder.

alcohol furnace the last obstacle has been removed which in some localities prevented the introduction of Dr. Jenkins's method. Besides these two, the Mitchell electric furnace (Fig. 57)* can be advantageously used for melting the Jenkins fillings. I have myself used it for two years with the best results.

The Jenkins gas furnace (Fig. 58) consists of an asbestos lined muffel, with an adjustable support, open in front and with an opening in the floor through which the flame enters. This is fastened to a base to which are also fixed the pipes for air and gas and the regulating device

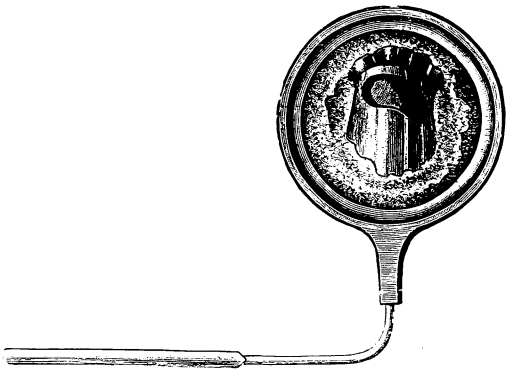


Fig. 55.

for the latter. To the stand are fixed an arm for supporting the handle of the melting cup and a shield of colored glass for the protection of the eyes. There belongs also to the apparatus a standing bellows connected with the blowpipe.

The alcohol-gas furnace (Fig. 59) varies but little from the one just described, the principal difference being that the gas necessary for use in fusing must first be made in the small retort at the right of the apparatus.

The process is thus described by Dr. Jenkins: "The alcohol holder after removal of the screw *a* is filled with absolute alcohol and the screw replaced. The valve *b* is only a safety valve and the alcohol is on no account to be poured through it. The lamp *d* is filled with ordinary

*Unfortunately this electric furnace has the disadvantage of not being durable. Repairs are frequently necessary on account of the burning out of the wires, making it needful to have a duplicate on hand in order not to be left in the lurch.

alcohol through the opening *c*, behind the holder, which is covered with a cap. Then the lamp *d* is lighted and the flame regulated by screwing the wick up or down. In a few minutes the absolute alcohol in the

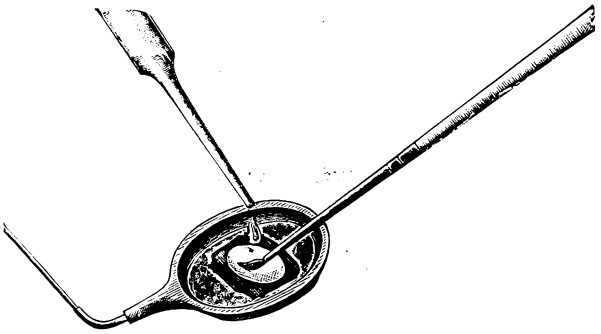


Fig. 56.

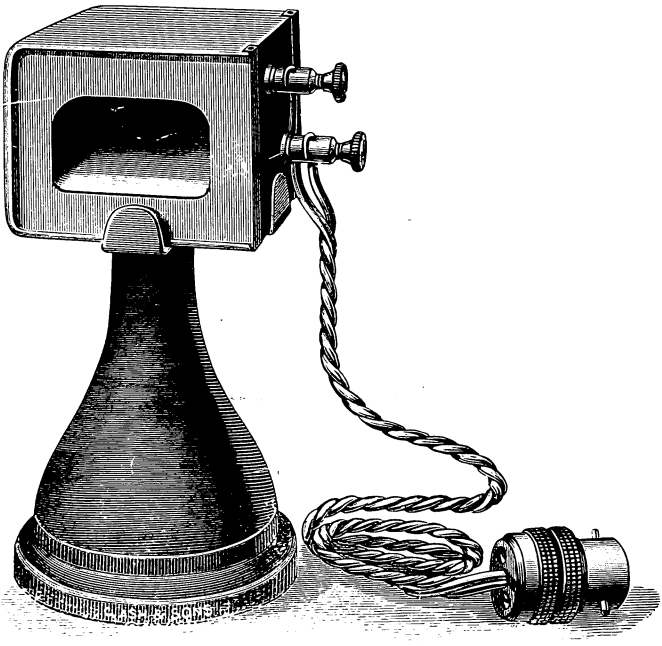


Fig. 57.

holder above the lamp will be sufficiently heated and the gas will find its way through the burner *e*. The products of condensation are carried into the receptacle *g*. As soon as the first drops fall into it, we can

light the burner *e*. The contents of *g* can be used for replenishing the lamp. The standing foot bellows is connected with the tube *f* and a flame obtained that can only be blown out by a violent use of the bellows. This flame can be regulated as desired by regulation of the lamp *d*."

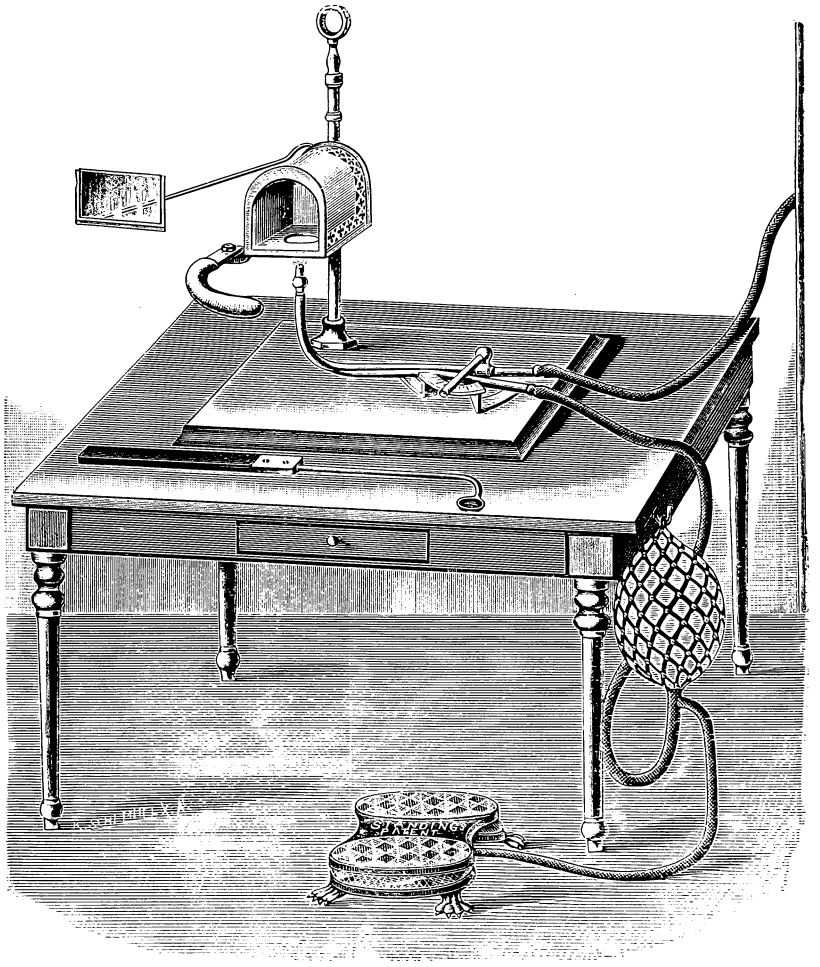


Fig. 58.

In using either of these furnaces for fusing fillings, one covers the melting cup with a nickel cap which has an opening through which the melting process can be closely watched (Fig. 51). We note here that the melting requires a longer time in the alcohol gas furnace than in the other.

Mitchell's electric furnace, which I use exclusively in the fusing of porcelain fillings, consists of a small box having an iron support. In the middle of the box is an opening 2½ cm. square. The interior of the

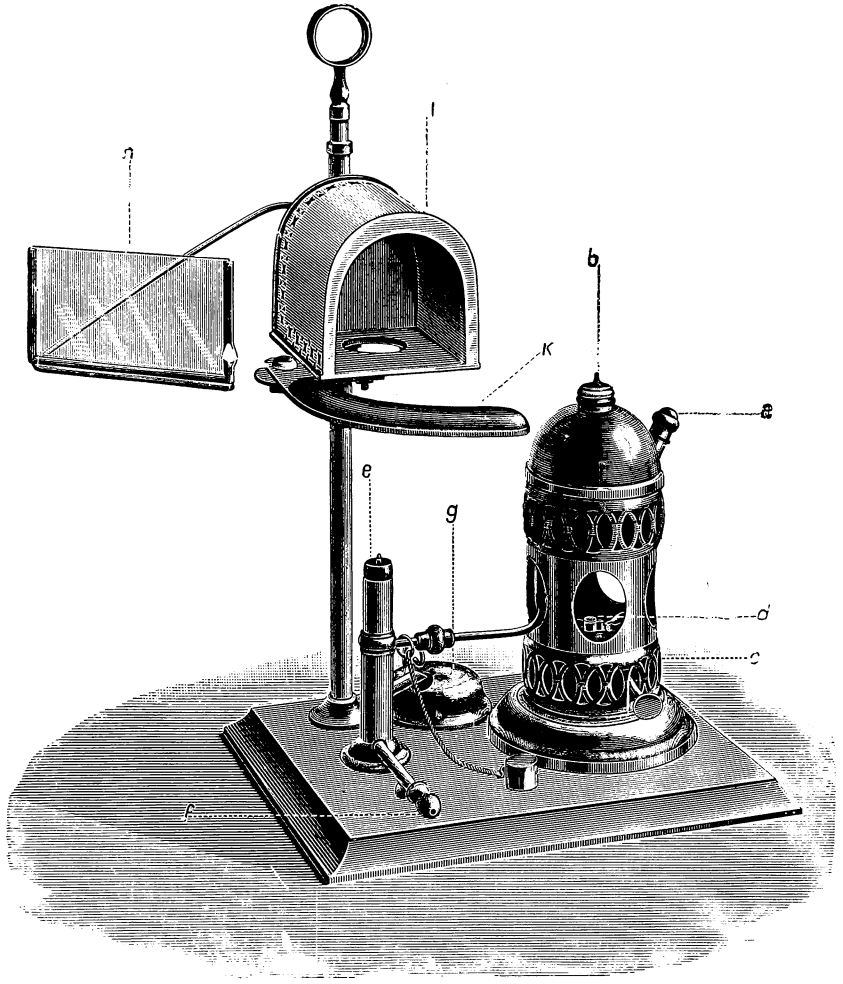


Fig. 59.

box is filled with an asbestos composition in which platinum wires are imbedded. Through connection with the electric current these wires and the mass of asbestos are brought to a glowing heat.

In order to prevent as far as possible the burning out of the wires, which, as I have already mentioned, often happens in constant use of the furnace, I have had a switch arranged close to my work bench so that when for a moment or two the furnace is not actually in use, as while the filling is cooling or I am adding more powder, I can at once shut off the current. By observing this precaution the repairs, so frequent previously, have become rarer.

In the Jenkins gas furnace the regulation of the intensity of the heat is brought about by an adjustment of the valve of the blowpipe to a scale with millimeter divisions; and in the alcohol furnace by raising

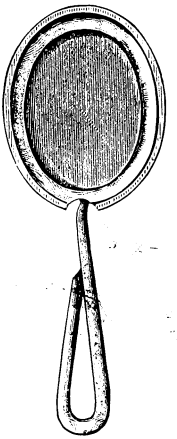


Fig. 60.

or lowering the position of the lamp, while in the electric furnace we effect the same object by breaking the current as already mentioned, resulting in the more gradual increase of the heat, or by introducing a rheostat into the circuit.

The question has been much debated whether when practicable one should use the electric furnace in preference to the Jenkins furnaces. For my own part, as above stated, I use only Mitchell's electric furnace, which with a properly regulated current has the same advantages as the two Jenkins furnaces and seems to me to have an essential advantage in respect of uniformity of heat and of the flowing of the porcelain. Moreover, the fillings can be fused in a shorter time, which to a busy man means a considerable saving. The same results, some say better results, can be obtained with the other two; in small places, where electricity cannot be had, the question need not come into consideration.

In using the electric furnace (there are others besides the Mitchell on the market) it is not necessary to cover the impression with the nickel

cap, since no soot is formed in an electric furnace, an advantage deserving consideration.

A slight change must be made in the shape of the melting cup for use in the electric furnace. Cut off the cup and wire from the handle, hammer the wire flat and bend it to the shape shown in Fig. 60. As the cup does not correspond in size with the opening of the furnace, the sides may be bent a little to admit of its being easily passed in and out.

Methods of Fusing.

The process of melting is the same with all these furnaces. Usually three or four fusings are sufficient, but in making large contour fillings a greater number are sometimes necessary.

For the first melting fill the impression to the edge with the porcelain powder (Fig. 61), but do not let it fuse entirely; but as soon as you

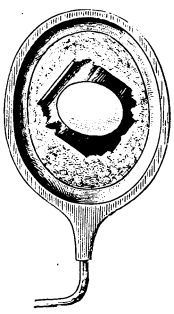


Fig. 61.

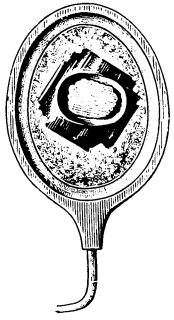


Fig. 62.

see that the mass has contracted and run together remove from the furnace. At this stage the surface of the porcelain is rough and has the appearance of a biscuit; although the impression was filled to the edges with powder, it has now so contracted that the bottom is scarcely covered (Fig. 62).

Dip the bottom of the cup in water, to cool it, *taking care that no water gets into the cup.*

Then with the drop tube let alcohol flow upon the filling from the edges—*not fall directly upon the filling*—and add more powder paste, pushing it with the brush into all the little depressions. *For this purpose the consistency of the paste should be very thin.* When certain of having filled in the paste wherever needed, we let one drop of alcohol fall directly upon the impression, then fill up to the edges again with paste, burn out the alcohol, and fuse a second time.

We now hold the melting cup so long in the flame that the mass becomes thoroughly fused and the surface smooth and shining.

Fig. 63 shows the filling after the second fusing. The porcelain enamel has now attached itself to the edges in two places, above and below, but on either side it has drawn away. These places, after cooling the cup, must be filled out as before described.* Now follows the third fusing. By turning the cup during the melting one can direct the flow of the porcelain towards any point desired. In the electric furnace we can set the cup aslant on the wall and attain this end more easily than with the other furnaces, where the cup is held in the hand.

After the third fusing in most cases, especially after a degree of skill has been acquired, the filling will be finished. It is better in the beginning to use less powder at a time and melt once or twice more

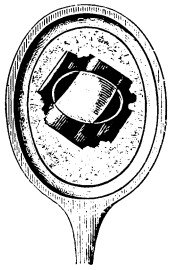


Fig. 63.

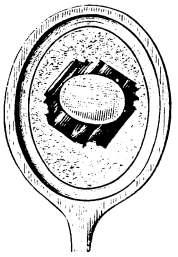


Fig. 64.

rather than make the filling too high and be obliged to grind off something from the filling after it is set.

Fig. 64 shows a perfect filling after three fusings. I could judge just how much powder to put in to obtain the desired height of this filling because I had in the imbedded impression the exact representation of the position of the cavity in the tooth. I would again emphasize this point. Allow so much of the goldfoil to overlap the edges of the cavity that you have this relative position before your eyes while melting and so may be able easily to determine what quantity of powder to add to make a perfect contour.

Use of Gum Colored Porcelain.

I now call attention to another use of the Jenkins powder. We often have occasion to fill front teeth whose defects not only extend under the gum, but also, on account of the recession of the gum,

*Dr. Hirschfeld recommends comparing the chosen sample on the fan with the piece in the melting cup before the third melting, in order, if the match be not perfect, to employ a different shade for the final fusing.

require a more complicated restoration. Fig. 65 shows such a tooth. For that part of the filling which is to supply the place of the normal gum tissue we can best use the gum colored porcelain powder supplied in the Jenkins outfit.

Fig. 66 represents this tooth filled with porcelain enamel, the gum being restored in form and color by the use of the rose tinted powder, giving the tooth its natural appearance.

If in such cases the defects are very small, and yet from their position at the necks of the teeth it is desirable to use the gum color for

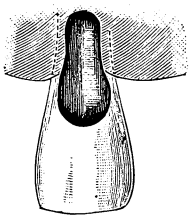


Fig. 65.

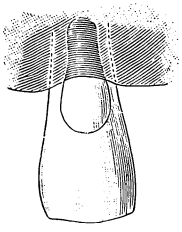


Fig. 66.

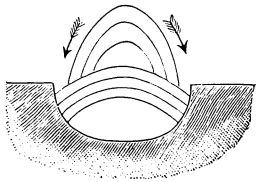


Fig. 67.

appearance sake, it is recommended to make the first melting of some other color and flow the gum color over it.

Although the Jenkins Enamel can be readily ground away and beautifully polished, yet by doing this we sacrifice the original lustre obtained in melting which no polishing can restore.

Fusing for Contour Fillings.

The melting process, represented in Figs. 61 to 64, is very simple; it is much more difficult when we have contour fillings to make. In such cases one must *take care in the second melting not to allow the powder to flow to the edges.* Melt as shown in Fig. 67, by layers, in order to prevent the mass from flowing over the edges. First melt in the shape of a flat ball at the bottom of the impression, adding successive layers: although the cut shows this only schematically, yet it is a plan that can be very nearly effected in practice. In melting we build the powder up higher than the real contour requires; it flows in the direction indicated by the arrows, so that we obtain just the desired contour. I mentioned in describing the taking of the impression that, in order to have, while melting, a certain guide as to the form and size of the piece to be built out, one should, after removing the goldfoil, model in gutta percha upon

the cavity the desired restoration, harden this model and keep it before him that he may know exactly where to place the porcelain powder during the fusing process. By following this method we avoid building out the contour in a false *direction*, a misfortune which cannot be remedied after the filling is finished. The more carefully one goes to work at the beginning of the melting process, the more successful he will be. To become thoroughly familiar with all the properties of the material and the several stages of the fusing process by previous practice is of course essential.

V.

The Preparation of Cavities and of the Completed Fillings for Insertion and Fastening in Position.

On completion of the melting process we let the porcelain cool off and then dip it in cold water; this last for the purpose of more easily detaching the goldfoil. With the tweezers we cautiously separate the foil from the filling, beginning at the edges, *which we must avoid injuring*. This can usually be accomplished without difficulty; if, however, as sometimes happens, the foil does not come away in one piece, but remains partially clinging to the reverse of the filling, we remove these bits with an excavator. The filling when ready for insertion should be *entirely free from particles of gold*.

If there has been a rent in the impression, we look for the place where the porcelain has united with the asbestos while fusing. This is readily discovered as a rough excrescence which is to be removed with a corundum stone, since otherwise the filling may not fit the cavity.

We now place the piece in the cavity to ascertain by examination with the lens—in cases where the cavity extends to the palatal surface by help of the mouth mirror—if it fits the margins closely at every point.

Though we may hold large fillings in the pliers, it is often impossible in the case of small ones. We can manage by using a broken plugger with the rough end dipped in mastic. It is well to lay a saliva apron, or towel, about the patient while handling the filling, to avoid dropping the filling on the floor and thereby losing much time in hunting for it.

Undercuts in Cavity.

The next item of procedure is to provide the cavity with undercuts for the retention of the filling. Since the making of undercuts, especially in labial cavities in front teeth, is often painful, on account of the nearness of the pulp, it is well to use an obtundent, such as menthol in absolute alcohol, in the proportion of 2 : 1, Validol camphoratum or pure carbolic acid.

In every case *use very sharp instruments and dry out carefully beforehand with hot air.*

For making undercuts use either rose or wheel burs. Do not make them too near the margin, but more towards the bottom of the cavity; when the filling fits well it is enough that it has a good hold at its base.

Undercuts in Fillings.

The filling must also be furnished with several undercuts, made to correspond, when practicable, with those in the cavity, thus forming a ring which filled with cement will surround the filling and give secure hold. Fig. 68 shows a section of a tooth filled with porcelain where the undercuts correspond as aforesaid.

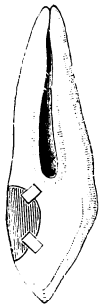


Fig. 68.

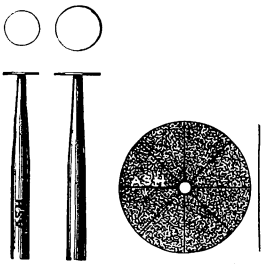


Fig. 69.

Fig. 70.

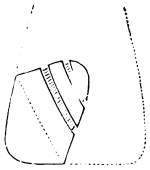


Fig. 71.

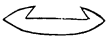


Fig. 72.

For making undercuts in the porcelain, thin nickel disks, of various sizes, covered with diamond dust, are used (Fig. 69). Those made by Ash & Sons are the best for this purpose, being more durable than other makes; but it is important to keep the disk wet while in use, since otherwise they become useless at once.

The undercuts in the filling should also not be made too near the edge, or the filling may break under the pressure of forcing it to place, though ever so moderately applied.

There are three kinds of undercuts used for the filling, the most common being a groove encircling the piece (Fig. 70); for specially large

fillings, as in the building out of contours, several parallel grooves (Fig. 71); and, lastly, the cutting out the center of the filling, as shown in Fig. 72, a method adopted for flat fillings.

There are other ways of making retaining points. For example: Erich Schmidt, of Berlin, lays bits of copper wire at the bottom of the impression, melts them into the porcelain and afterwards dissolves out the copper by boiling in nitric acid.

In my opinion, the cuts made with the diamond disk give greater security to the filling. In order to make them one holds the bit of porcelain with thumb and finger of the left hand, having previously moistened and dipped them in pumice powder to prevent slipping, and cuts the groove with the diamond disk in the engine, using as little pressure as

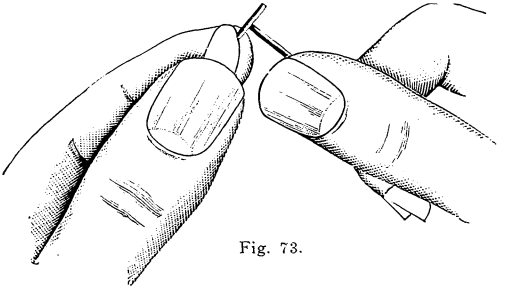


Fig. 73.

possible. In Fig. 73, I have attempted to show the manner of holding filling and disk, the position of course constantly varying with the progress of the cutting.

After making the undercuts wash the filling carefully, dry with a napkin and hold it over an alcohol flame to make sure that no moisture is left in the undercuts. It may happen that too quick heating of the porcelain may crack it; in which case one can take a new impression of the cavity, lay the broken pieces into it, and remelt. Since some of the material has been cut away in making undercuts, it will be necessary to add some porcelain powder before melting to ensure the original height of the filling. The advantage of this is that it saves a threefold melting.

Setting the Filling.

The filling is fastened into the tooth with cement. Those cements should be used which have the finest possible powder and which do not harden too quickly. Dr. Jenkins has had a cement made expressly for setting his fillings; it is specially manufactured by the makers of the Harvard Cement in Berlin. For a year and a half I have used successfully S. S. White's Alphos Cement.

If on trying in the filling one finds it too light or too dark, it can be partially remedied by using respectively a darker or lighter cement, sometimes by mixing the phosphate powders. The mixing of the cement requires the most thorough incorporation of the powder and fluid, since the smallest lump in the cement will cause failure. The consistency of the cement must be that of cream, but on no account thinner, or it will not harden with sufficient strength for permanency.

Put a small quantity of cement into the cavity and distribute it into the undercuts with a suitable instrument. I use for the purpose the one represented in Fig. 74. Then with a small and thin spatula (Fig. 75) fill the undercuts in the porcelain filling with cement and set it in place. I give here a useful hint, and illustrate with the example shown in Fig. 76. Put in first that side of the filling which lies near the cutting edge and press gradually to place, so that the superfluous cement may be pushed out before the filling in the direction of the arrow. By so doing one prevents the lifting of the filling by any air that may have remained in the cavity.

It is not necessary to use a great quantity of cement in the insertion of a filling. It suffices to fill the undercuts and to have enough that a little overplus be visible, oozing out at the edges of the filling. This overplus is removed with a narrow linen tape (Fig. 77). The filling is then held firmly in place with a flat piece of hickorywood (Fig. 78) until the cement begins to harden.*

Dr. Green, of Albany, recommended in the *International Dental Journal*, 1896, to warm the filling just before insertion. I have tried it several times and cannot too strongly warn against doing so, since it causes the cement to harden before one can bring the filling into the proper position.

It is best not to remove the rubber dam or mouth napkin until the cement left on the mixing plate is quite hard. If obliged to admit saliva sooner, melt over the filling and margins a thin coat of paraffine under

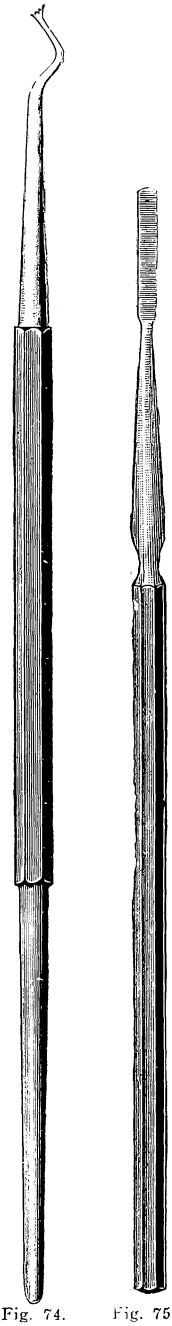


Fig. 74. Fig. 75.

*A very important requirement, too often not observed.—EDITOR.

which the hardening process will continue undisturbed. I cover *all* fillings with such a layer of paraffine, which, with the remaining particles of cement, is afterwards removed by the patient in the act of brushing.

With practice one will rarely make a filling that does not exactly fit the cavity. Should it happen, however, that a filling is too high, or that the porcelain has flowed over the edges, one can remove the superfluous part with corundum stones and sandpaper disks (if one does not prefer to make a new filling) either before or after setting in place; in the latter case after a day or two. For polishing the surface roughened by this grinding, use sandpaper disks for approximal and Arkansas stones (Fig. 79) for labial and buccal positions.

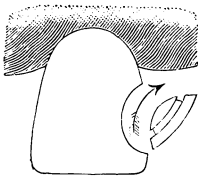


Fig. 76.

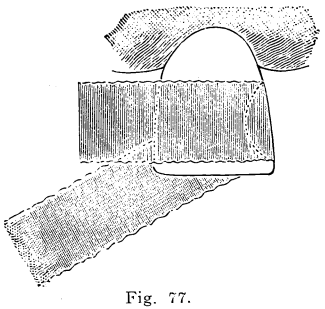


Fig. 77.

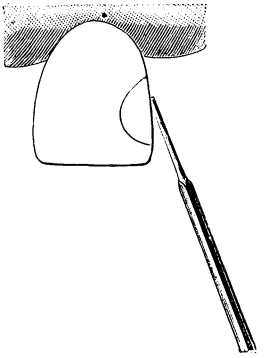


Fig. 78.

Sealing the Cavity.

In concluding this part of the subject, I must contradict the statement often advanced by opponents of porcelain fillings, viz.: that a porcelain filling never properly seals a cavity, since there is always a space of the thickness of the goldfoil between the filling and the walls of the cavity; the cement which fills this space must soon be dissolved by saliva, leaving the tooth unprotected from secondary decay, and the early falling out of the filling is inevitable. How mistaken this opinion is I would show by means of the three following illustrations:

Fig. 80 shows a section of a properly prepared cavity. Fig. 81, the same cavity, in which is laid the filling still enclosed in the goldfoil impression. (The goldfoil is here purposely represented thicker than it

actually is.) In Fig. 82 the goldfoil is removed, and the filling lies in the cavity without it.

Although *on account of the thinness of the goldfoil there is no space left, worth mentioning, between the walls of the cavity and the filling, yet since in the case of properly prepared cavities the fillings, after the goldfoil is removed, sink deeper into the cavity to an extent corresponding to the thickness of the goldfoil, this space consequently disappears entirely and there is barely room left for cement.*

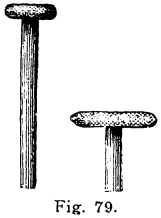


Fig. 79.

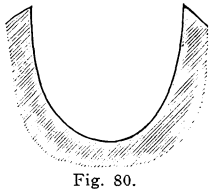


Fig. 80.

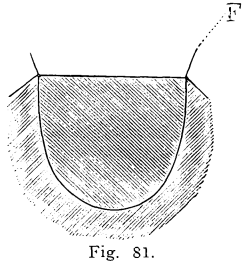


Fig. 81.

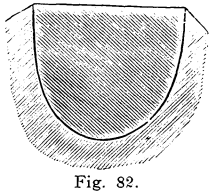


Fig. 82.

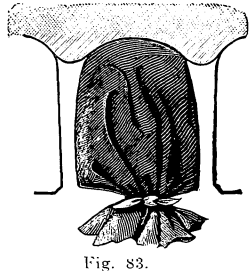


Fig. 83.

In order not to keep the patient in discomfort from the rubber dam while the cement is hardening, one can draw the dam over the tooth, as shown in Fig. 83. By means of this arrangement the patient can wait in a neighboring room while the operator attends to another.

VI.

Application of the "Porcelain Enamel" of Dr. Jenkins to the Restoration of the Larger Defects in Teeth.

Beside its use for fillings of ordinary size and form and for restoring the contour, there are many other cases in which porcelain enamel can be employed, such as defects from traumatic causes or where large portions of the tooth have been destroyed by decay.

In cases where formerly the only method possible was to set a crown, the same or even better results may now often be obtained by the use of

this enamel. Of course in such cases one must carefully take into consideration whether the bite may endanger the durability of the work.

If the bite does not in any way interfere, one can replace large portions of teeth with porcelain enamel without anxiety. The patient will not be obliged to take more care in using teeth built out with porcelain enamel than he would of a Richmond crown, which we often use in such cases.

Before I proceed to the description of these cases, I would call attention to the principle that in this work *the depth of the cavity should nearly correspond to the size of the contour to be built out,* in order that the porcelain may have a firm hold (Fig. 84). I do not think it absolutely necessary to anchor it with posts or stays; indeed, in many cases, I think their use disadvantageous in relation to durability.

From the many cases in which I have restored large defects by the use of porcelain enamel in the last few years, I select only the following for description here.

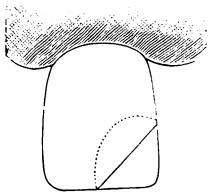


Fig. 84.

Case I. The locksmith's apprentice, F., fell through a glass roof and broke his right superior incisor. The pulp was exposed, and the patient experienced great pain on opening his mouth. He came to the Breslau Dental Institute and was sent to the operative department under my supervision. The fracture ran from the mesial wall rather near the gum obliquely downward to the distal wall. The first thought in treating so great an injury was, after destroying and removing the pulp, to set a Richmond crown, but I decided against it, since this kind of fracture did not demand an operation that should remove the whole crown to the root.

At the first sitting by using *Anestile Bengué* I removed the pulp, and for several days treated the pulp canal with iodoform-ether, since the shock had induced a slight irritation of the peridental membrane. I then filled the root canal and prepared the tooth for the insertion of a large piece of porcelain. This filling has now been in place over a year.

Fig. 85, from a photograph not retouched, represents the outline of the filling and indicates how little it shows in the mouth.

Case II. A young girl of 14 came under my care for treatment of the right superior incisor, destroyed by decay, as shown in Fig. 86. It was the express wish of the parents not to have a Richmond crown, so I was obliged to see what I could do with porcelain enamel, and succeeded extraordinarily well, as appears from Fig. 87.

Fig. 85.

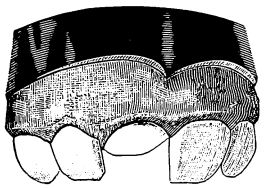


Fig. 86.

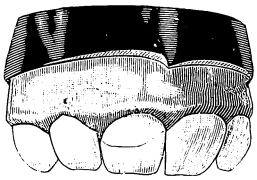


Fig. 87.

Case III. This case needed the restoration of a front tooth. It had been filled with cement and became discolored. After excavation there was scarcely anything left of the labial wall but the enamel. When the porcelain filling had been set, the original form and color were restored, and the patient is able to use the tooth as formerly. Fig. 88 and 89 show the tooth before and after treatment.

Case IV. This patient came to have an artificial piece made. The incisors were all gone; both cuspids were partially destroyed by decay proceeding from the points and had been filled with gold. The plate which the patient was wearing had been constructed in relation to these shortened cuspids, and

the appearance of the short teeth was unpleasing. On touching the gold fillings with an excavator, I found them ready to fall out, and therefore removed them and restored both cuspids with large and deeply seated porcelain fillings. Now that the cuspids had their original form, I could use teeth of normal size in making the new denture. In this case I had also the opportunity to use porcelain enamel in another way. In trying in the piece I observed that the root of the left upper incisor (that of the right was absent) had altered its position in the course of time and lay inclined towards the cuspid in such a way that a part of it came into view between the incisors of the artificial piece. In order to get rid of this blemish, I fused some porcelain enamel No. 18 (gum color) into the

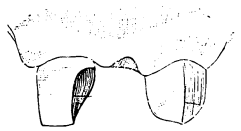


Fig. 88.

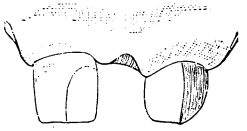


Fig. 89.

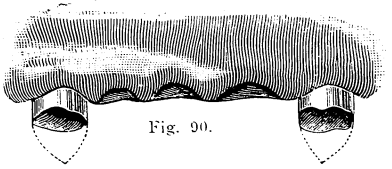


Fig. 90.

space between the two artificial incisors, and thus concealed the root from view (Fig. 91).

I could describe many such cases, but these may be sufficient to show that porcelain enamel can be used to advantage for large defects.

Crowns.

In making *pivot teeth and crowns* I have also had good results with the Jenkins enamel.

For a pivot tooth select first a platinum pivot that fits the root well and cut several retaining notches in it with an Arthur disk. Take an impression of the root and grind a tooth to fit. Bend the pins around the pivot, as seen in Fig. 92, and try pivot and crown thus joined in the root. If the tooth has been ground to fit perfectly, remove, and with a Herbst polisher burnish a piece of platinum foil upon the face

of the root projecting from the gum. The position of the root canal will be plainly marked. Putting some wax upon the artificial crown, push to place in the canal and, making sure that the crown has the proper position, withdraw carefully; the foil will cling to the wax (Fig. 93). Then imbed in a melting cup which Dr. Jenkins has devised for this special purpose and which has a platinum spiral to receive the pivot (Fig. 94). Fuse porcelain enamel upon the reverse of the crown until you have it as seen in Fig. 95. The enamel will unite so closely with the artificial tooth that if the bite requires it it can be cut down nearly to the pins without impairing the durability of the tooth.

In constructing these pivot teeth we must beware of cooling them off too quickly, since artificial teeth crack more easily than the fused porcelain enamel.

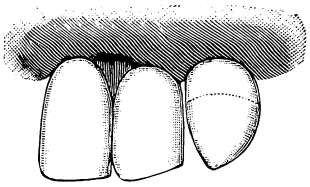


Fig. 91.

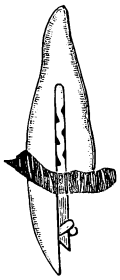


Fig. 92.

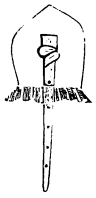


Fig. 93.

The Jenkins powder can also be used for crowns with success. In Fig. 96 is shown the root of a molar with a ring of gold fastened with cement. After removing the superfluous cement take an impression with goldfoil and fuse porcelain into it. Form the fissures with an instrument before the mass hardens.

Jacket Crown. Dr. Jenkins, following an idea of Fenchel's, uses porcelain enamel in making the so-called "jacket crown." Fenchel puts a platinum ring on the root, which after trying in he gives the form shown in Fig. 97. Then he makes little cuts in the upper rim and bends as seen in Fig. 98. The ring can then be imbedded in asbestos and porcelain enamel fused in it. By means of the platinum cut in parapet shape and bent inwards the porcelain is held so securely that whole crowns can be built up with safety (Fig. 99).

In regard to this Dr. Jenkins writes as follows: "In many cases of a close bite, or for the restoration of fractured or undeveloped teeth where the pulp is still alive, this jacket crown can be used with success. It makes a very strong crown."

Dr. Jenkins is well satisfied with results obtained by the Fenchel method, both in respect to durability and beauty, and uses it in his practice

Methods of Dr. Geo. Evans.

Dr. George Evans, of New York, has also used the Jenkins enamel for other operations than filling. He employs it for covering gold or platinum crowns with a layer of sightly material.

He sometimes cuts off the pins from an artificial tooth and grinds it so thin that only the outside labial surface remains; he then fuses this facing upon a gold crown, using porcelain enamel with marked success.

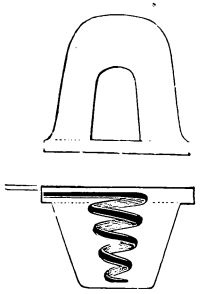


Fig. 94.

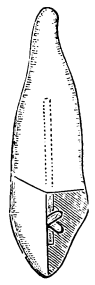


Fig. 95.

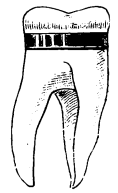


Fig. 96.

Fig. 97.

Fig. 98.

Fig. 99.

Molar Crowns.

I have seen Dr. Jenkins make another interesting use of the enamel in preparing a crown for a lower molar. He made a platinum ring to fit perfectly the edges of the root; regulated the height of the ring, and took an impression of the ring and root; then soldered platinum upon the ring, making a cap that perfectly embraced the surface of the root. From the part of the ring above the cap a piece was cut out on the buccal side and a half molar, provided with a backing, was soldered on. Then, in order to make certain of correct articulation, the cap was tried again in the mouth.

The ring was now filled with porcelain enamel powder and the fusing continued until the occlusion with the antagonist was perfect. The porcelain united with the tooth most compactly. After another trial in the mouth, the platinum ring visible above the gum was covered with gum porcelain enamel. Dr. Jenkins believes that he can make no stronger nor more durable crown than this.

I have also made a crown after this method, and in order to give the ring a still firmer hold on the porcelain I cut and bent the platinum after Fenchel's method (Fig. 98).

From the variety of examples already given it may be seen how great a field of usefulness opens out for the extended use of porcelain enamel, especially if one most carefully takes into consideration all circumstances in making choice of it for each particular case.

Having come now to the conclusion of my descriptions of Dr. Jenkins's method, I would once more point out how valuable, when properly and conscientiously used, this process is, both to our patients and to ourselves.

Its introduction constitutes for the dental profession an event of far reaching significance, and ensures for the discoverer the gratitude of all who regard dentistry not merely as a scientific handicraft, but rather as calling for the exercise of æsthetic and artistic judgment and skill.

Conclusion.

When we take into consideration the difficulty with which nearly all our most useful filling materials were introduced into use, and read in the journals of earlier decades of the bitter contests waged, for example, against amalgam, a material which no dentist today could spare, we can understand that there is likely to be much opposition to the filling of teeth with porcelain.

The mistrust of new discoveries and methods is to a certain degree excusable, since it often occurs that quite useless innovations (I recall especially many of the preparations for treating the pulp) are extravagantly praised. It is certainly desirable that warnings founded on experience should be published in the case of useless and worthless things.

When Dr. Jenkins, whose standing as a practitioner I have no need to certify, made known his method, after years of experiment, he not only explained it theoretically in a manner worthy of admiration, but also exhibited it practically in the mouths of his patients with brilliant and almost never failing success. Such a discovery, thus announced, may be received at once with a good degree of confidence. That in this case confidence was completely justified is proven by the many satisfactory trials of this method made by German dentists and reported by them both verbally and in writing. So much the more astonishing is it that such really useful discoveries are often subjected to unreasonable criticism.

Although I have already emphasized the excellence of the Jenkins method and of the porcelain enamel, I wish in conclusion to combat some of these unfounded criticisms.

In describing the setting of the porcelain filling, I took occasion to deny the assertion that the cavity was not perfectly closed by such fillings. I will now adduce other examples showing how unjustifiable are some of the objections urged against this method.

Jenkins's Porcelain Not Glass.

It has been claimed that the Jenkins material does not differ essentially in composition from the glass powders previously in use, *and that it melts over a Bunsen burner, which fact justifies the suspicion that it is nothing more than a glass compound.* Since I have busied myself in these last years not only with making fillings after the Jenkins system, but have also been interested in studying the composition and the fusing point of the porcelain enamel and of other compounds of like nature, I am prepared to give some particulars upon both these points, viz.: that the Jenkins material is believed to be a purely glass mixture and that it melts easily over a Bunsen burner.

I had some of the porcelain mixtures which have come most into use analyzed in the Chemical Institute of the Breslau University, the result being *that the Jenkins powder is shown to be almost identical in composition—the variation being very slight—with the so-called "high fusing porcelain" as well as with the hard German porcelain tested by H. Seger but not more exactly designated.**

As to the fusing of the Jenkins powder over a Bunsen burner, I am not surprised at it, since the flame of the Bunsen burner has a heat of more than 1,300 degrees in its hottest part, in which heat all the compounds used for porcelain fillings, including even the high and low fusing materials used by Ash in his artificial teeth, may be melted.

In order to be sure of this I made, last summer, a series of experiments in the Physical Laboratory of the University, and noted the melting points with the scientific instruments in use there.

	Begins to melt.	*Melting process completed.*
Kaolith (Glogau)	At 693 degrees	At 870 degrees
Glass powder (Herbst)	" 790 "	" 894 "
Composition (Möser)	" 810 "	" 890 "
Porcelain enamel (Jenkins)	" 850 "	" 910 "
Ash's "lowfusing,"	" 865 "	" 1,000 "

The figures marking the beginning of the melting are given here with addition of 20 degrees, because this was the temperature of the room.

From this table it clearly appears that materials having a still higher melting point than any of these can be melted over a Bunsen burner.

*Von Wagner, Handbuch der Chemischen Technologie. Leipsig, Otto Wiegand, 1889.

Grinding and Polishing.

At a meeting of the Brandenburg Society of Dentists, Feb. 3 and 4, 1900, the Jenkins compound was charged with two other defects. It was maintained in a paper read on that occasion that the Jenkins enamel could not be ground and polished without losing its transparency, and it was asserted by another speaker that fillings of porcelain enamel became dark, indeed almost black, in the mouth.

As to the first assertion, I refer to my remarks on the subject of grinding away too high porcelain fillings. The other charge has been refuted by Torger in the *Zahnärztliche Rundschau* in these words: "A discoloration or blackening of these fillings is out of the range of possibility."

I have myself never yet found one among the large number of fillings that I have made with the Jenkins material which had changed color, not even at the points where the tooth had been ground and polished. Nor have I seen any sign of the porousness of which the material has been accused by some.

Retention by Cement.

Prof. Hesse, in his last lecture on the Jenkins porcelain filling before the Central Society (1901) mentioned the mistrust so often expressed by opponents of this method in regard to the retentive power of the cement. He is of the opinion that since the old glass and porcelain fillings have stood the test for years though held in place only by cement, it was not the lack of durability in the cement but of the material of which the fillings were composed that gave cause for complaint. So long as we have no more trustworthy material for fastening inlays in place, we must let what we have suffice. The most of the attacks on the Jenkins method are based on an insufficient freedom from prejudice or on an inadequate experience in the use of the material. Whoever will make himself acquainted with the brilliant results that have been attained will gladly enroll himself among the great number of the followers of this system. Only years of practice with a new filling material can qualify us to give a final judgment upon its capabilities and durability. One should not allow himself to be led to a premature condemnation on account of failures at the beginning.

Undoubtedly the future of operative dentistry is to be in large measure concerned with the employment of porcelain as a filling material, and we may expect with increasing perfection in the methods and materials that we shall in time possess that which is so much needed—a compound that shall meet *all* the requirements that we must demand of an "ideal" filling material.

Appendix.

Porcelain Inlays.

In the section devoted to the historical development of the method of filling teeth with porcelain, I have mentioned the use of pieces of artificial teeth as inlays. I can therefore restrict myself here to a few remarks which may give a better idea of these fillings. There have been several ways in use of making porcelain inlays. The simplest, it seems to me, is that recommended by Prof. Sachs. He selects a front tooth of

Fig. 100.

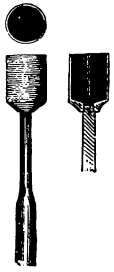


Fig. 101.

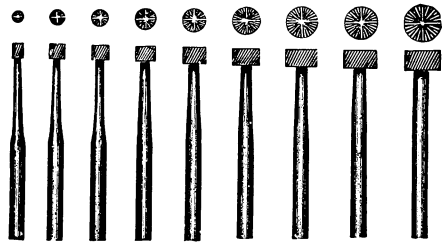


Fig. 102.

White's manufacture which matches in color the tooth to be filled and cuts out of it a round piece which nearly corresponds in size to that of the cavity. Fastening this with shellac to the end of a burr, he lets the engine revolve to the right while he holds the porcelain against a fine grained wheel of the lathe revolving in the opposite direction. One can also, in order to obtain a more perfect joint, fill the cavity with wet pumice or emery powder and thus polish to a nicety in the cavity itself.

The pieces are given a somewhat conical form, so that if they do not at the first trial exactly fit the cavity the small end can be cut away and the piece sunk deeper into the cavity. The lower part is grooved (Fig. 100), and a groove is also made in the tooth. Later, in order not to consume too much time in preparing an inlay for each case, Sachs made out of artificial teeth which had been discarded for other uses a large number of porcelain inlays of various sizes.

Another method is (by means of one of White's trephines (Fig. 101).

which are made of copper charged with diamond dust, and can be had in several sizes) to cut from the selected tooth a piece of the required size. This method has the advantage that one can cut out from the artificial tooth the piece which best matches the shading of the natural one and will render the defect least visible. There are also to be had for this work cylindrical burs having the same diameters as the trephines (Fig. 102).

For holding these small porcelain inlays while being ground, How has made some metallic rods (Fig. 103), which are to be set in a mandrel

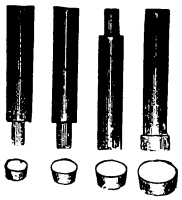


Fig. 103.

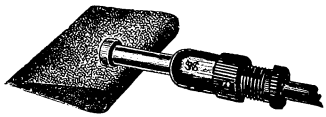


Fig. 104.

Fig. 105.

Fig. 106.

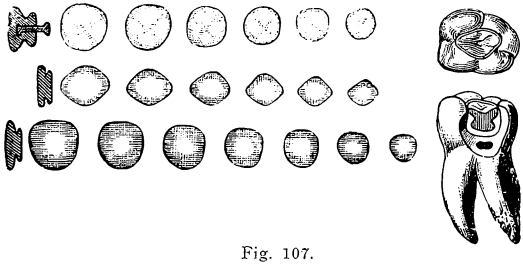


Fig. 107.

as shown in Fig. 104, for use on the engine. By this means the inlay can be given the desired shape by holding it against fine grained corundum or emery.

White and Ash have also prepared for porcelain inlay work, from the same substance as their mineral teeth, small rods of various shapes and colors from which the piece required can be cut off (Figs. 105 and 106). Finally I would mention the inlays manufactured by Ash for large cavities, some of them provided with platinum pins for molar teeth (Fig. 107).

All these methods have been superseded by Dall's system, which has greatly simplified the work and essentially shortened the time necessary to prepare such fillings.

Dall's System.

Dall engaged the firm Ash & Sons to furnish so-called "ground inlays," made of the same material as their artificial teeth, in sizes corresponding to a steel gauge (Fig. 108). These inlays are of two thick-

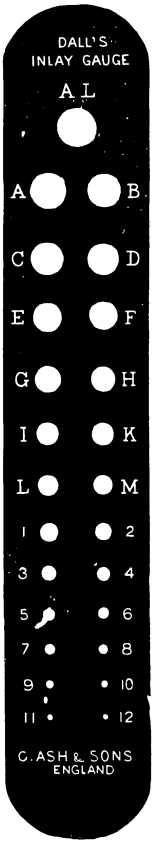


Fig. 108.

Fig. 109.

Fig. 110.

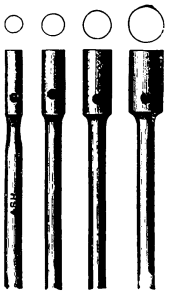


Fig. 111.

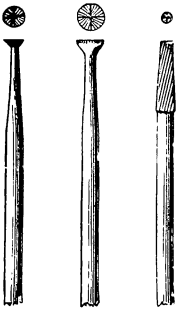


Fig. 112.

nesses (Fig. 109); both have grooves on the under side, and on the outer a little button by which the inlay may be seized with the pliers, which makes the trying in and setting much easier. The thicker inlays have a retaining groove. There are twenty-five sizes of inlay corresponding to the same number of holes in the gauge, and also twenty-five large burs

marked on the shaft with the number corresponding to the gauge (Fig. 110). These burs are slightly conical in shape and give the cavity the exact form of the inlay selected.

Dall has also constructed four inlay holders (Fig. 111) for use when the inlay has to be ground away on the under side. The top of the inlay with the button is fastened into the holder with shellac.

The process of setting such inlays on labial surfaces is as follows: Remove all decay from the cavity with a rose bur, and with the burs above described give it a circular shape; in doing this take great care to hold the bur perpendicular to the required plane of the filling and that the bur runs true in the handpiece, or the desired form will not be obtained.

Fig. 113.


Fig. 114.

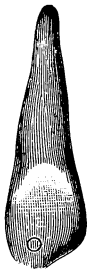


Fig. 115.

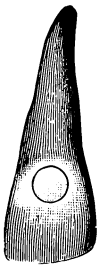


Fig. 116.

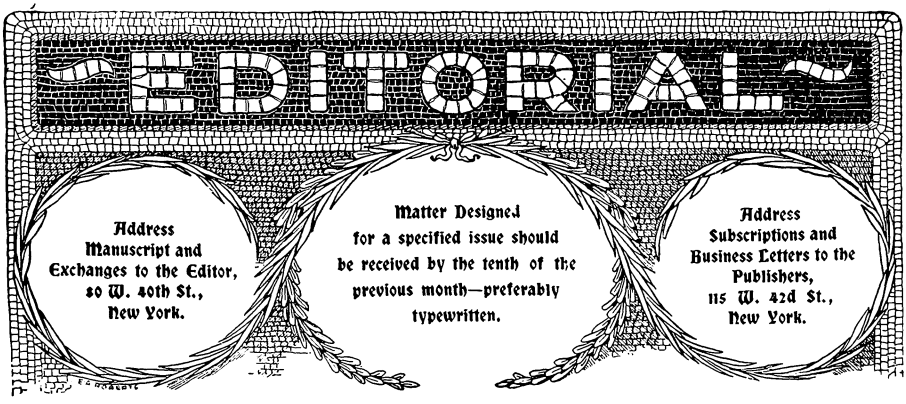
When the cavity has sufficient depth, make an undercut with Dall's undercut bur (Fig. 112). With the pliers take the inlay which corresponds with the size of the bur and place it in the cavity. If it is too high, the lower surface may be ground away until it corresponds with the edges of the cavity, but there must never be so much taken away that the edge of the cavity is above the inlay, but the edge of the inlay must always stand a trifle above the edge of the cavity wall. If there is no retaining groove in the piece selected, one is easily made with the diamond wheel (Fig. 113), always kept wet.

After putting a little cement of the consistency of cream into the retaining grooves in both inlay and tooth, set the piece with a small surplus of cement. The little button is to be nicked with the diamond wheel and excised. When the cement is hard, remove the extra portion with a corundum disk and polish the surface of the porcelain inlay with an Arkansas stone.

We prefer these inlays to melted fillings for small, round cavities. The cuts 114 to 116 show cases in which the use of the Dall system is advantageous.

For all irregularly shaped cavities, or when to make a round cavity would involve too much destruction of tooth substance, we prefer the Jenkins method. This only requires that we remove the decay and enough tooth substance to prevent secondary caries.*

*It should be said that Dall has in view the preparation of inlays of irregular shape, but I maintain that for such cases fillings melted in an exact impression of the cavity more completely fulfill the purpose sought.



Extension for Prevention.

The papers published in ITEMS OF INTEREST for May, 1901, seem to have started a discussion which has not yet ceased. The *Dental Review* for June contains a number of papers read before the G. V. Black Dental Club of St. Paul, and in nearly all of them extension for prevention, and allied problems, are freely discussed.

Dr. G. V. Black's Paper.

The opening article is from the pen of Dr. Black himself, and should be studiously read by all interested in the proper filling of teeth. It purports to be a resume of previous papers, but as a specimen of succinct logical writing it is one of the best literary products of the year, and moreover Dr. Black's views and theories seem better expressed than ever before. There appears to be a slight modification of previous tenets, a little less radicalism in the teaching, but perhaps this is only seeming due to previous misinterpretation of doctrines less clearly expounded heretofore. In one place Dr. Black credits Dr. Marshall H. Webb with having held very similar views prior to the first publication of Dr. Black's own articles, and then he says: "It seems, however, that he was unable to put his plans of procedure into descriptive words, probably from a want of sufficient knowledge of dental anatomy, and the lack of terms in which to express his thought." Yet a great many comprehended Dr. Webb very well and practiced his method. However that may be, it can never be said that Dr. Black has not fully and intelligibly expressed himself.

Yet, despite the admirableness and timeliness of this paper, there is something lacking, a certain meed of disappointment being felt after its perusal, even thrice over. Dr. Black's theories, in a measure, have been criticised, yet Dr. Black is content to merely restate his position in language more clear than heretofore, but while he dogmatically asserts the correctness of his position, not one new argument in support thereof is proffered. The contention is whether or not it be true that small approximal filings are (in the majority of cases) doomed to failure from recurrence of decay. Dr. Black says "Yes." Others say "No." And in reply Dr. Black merely says "Yes" again. He describes surfaces which are not cleansed by the passage of food during mastication, and alludes to "a central area of greatest liability in which decay acts more quickly, with a lessening of the intensity as we recede from a given center, and with a constant tendency to superficial attack in a widening zone toward the angles of the surface where immunity is usually reached." Then he says: "If we prepare and fill the central area of decay only, and make the filling ever so perfect, we will, if the conditions remain the same, soon have recurrence or re-beginning of decay at the margins of the filling."

But Dr. Black does not tell us why this recurrence is at the margins of the fillings. Why not elsewhere in that region which is prone to decay, and why not as a distinct new cavity, independent of the filled area? Why indeed, unless it be that the fault was along that margin and due to improper manipulation rather than to improper position.

Later Dr. Black calls special attention to the modifying clause in the above quotation. All the disaster predicted is to occur only "if the conditions remain the same," and we are told that often they do not; that the greatest depredations of caries are during childhood and that passage of time brings added immunity. Thus occasionally at least the small fillings succeed, because by chance the conditions of the mouth change, and decay becomes less rampant. Under such a doctrine then, the older the patient the less need of extension, and even in young mouths the extension is made because the conditions may not change for the better. But if there is any valid reason for extension under this aspect of the argument, there must be a reasonable number of patients in whose mouths the conditions do remain the same; indeed there should be a majority of such instances to establish the practice. And if this be true, it is

difficult to comprehend the success that some men have achieved with small approximal fillings. At least they should have met an appreciable number of failures, if recurrence around small fillings is to be seriously apprehended.

If the excursions of food suffice to render the axial angles immune to decay, Dr. Black should give us the scientific explanation of caries along the labial surfaces of the anterior teeth, the area of all others most thoroughly cleansed with the tooth brush; and should Dr. Black, or some other, prepare a paper dealing with these festoon cavities, let him not overlook the fact that the inception of caries here is usually at the center, the highest part of the curve of the tooth surface, the place of all others in the mouth reached most often by the tooth brush.

Dr. Wedelstaedt's Paper.

In the same issue of the *Review* is to be found a paper by Dr. E. K. Wedelstaedt in which specific reply is made to those who discussed this subject at the Brooklyn meeting. This paper is accompanied by a dozen illustrations of teeth having fillings which have failed. They are very nice pictures, but if they were introduced to establish Dr. Wedelstaedt's contention, they might better have been omitted, since they really aid the opposite argument. Two at least are absolutely illogical, since not only are they occlusal surfaces of molars, which even Dr. Black admits is another matter, but in neither case had the sulci been fully cut out; in one apparently not at all. In all of the others, with possibly one exception, the margins never could have been rightly formed by any doctrine, if we may judge by the shapes of the filling masses, which of course represent the original boundaries of the cavities. Thus instead of representing recurrence due to improper environment, these fillings undoubtedly failed because of faulty manipulation; neither have they failed in any particular direction, but seem to have sprung aleak in all directions. Dr. Wedelstaedt is fond of compiling statistics from old teeth in his collection, yet here we find that the first lot which he really exhibits offers opportunity for diametrically opposite reading.

At the Brooklyn meeting Dr. Wedelstaedt offered some statistics based on the examination of a hundred filled teeth taken at random from his collection. The following is quoted from his paper in the *Dental Review* (June):

"Eighty-five of the 100 had cavities of decay due wholly to non-extension for prevention. Eighty of these filled teeth contained amalgam, and twenty contained gold. In closing the debate Dr. Ottolengui throws out as valueless the teeth filled with amalgam. He thus leaves the subject with which he deals and attempts to deal with filling material. This action on his part will not do, for he must deal with failures, as they are all due to the same causes, irrespective of the filling materials used."

Yet in another paper recently published Dr. Wedelstaedt tells us, and tells us truly, how few men know how to make a permanent filling with amalgam. Dr. Black also gave us a long study of the failures of amalgam, in which a prominent characteristic was shrinkage, thus forming inviting abiding places for the forerunners of decay. How then can we place any reliance upon statistics based on teeth filled with unknown alloys, by unknown methods, and at unknown periods in the past? How can failures, so probably due to the material, be used as an argument in a discussion of failures due solely to the cavity formation? Dr. Wedelstaedt simply has not grasped the logical reason for throwing out the amalgam filled teeth.

Diagnosis by Means of the Blood

By Robert Lincoln Watkins, M.D.
With one hundred and fifty-four photomicroscopes.
Physician Book Publishing Co., New York, 1902.

The character of this book may readily be inferred from a study of the table of contents and the index; nor is the perusal of the text at all contradictory of the inferences thus gained. The table of contents at once shows the fragmentary and desultory interest of the investigations on which the author's conclusions are based, and also reveals a classification which is both novel and archaic. Thus a few general introductory sections are followed by chapters on Moving Blood Cells, Dry Blood, Healthy Blood, Unhealthy Blood, Tuberculosis, with sub-sections on Tuberculous Fibrin, Pulmonary Tuberculous Cases, Inherited Tuberculosis, Recovery from Tuberculosis, Ulcer of the Stomach (*sic!*); Septicaemia, Blood in Rheumatism, Crystals in Blood; Embolus with subsection on Paralysis, Cow's Blood, Cardiac diseases, Meningitis, McKinley's case, Syphilis, etc., etc.

This chaotic, incomplete and most unscientific arrangement is equally evident from a study of the index. Elaborate as is the latter, yet the reviewer failed to find a single reference to anæmia of any kind—even the word anæmia is nowhere to be found; chlorosis, leukæmia, pseudoleukæmia and indeed any of the ordinary diseases of the blood are also missing. The name of Ehrlich, to whom we are so deeply indebted for the present advanced state of hæmatology, occurs but once, on page twenty-one, where we find the only reference to the dry methods and staining. Of these, the most valuable diagnostic methods at our command today, not a single word or description is to be found anywhere. Yet pages are devoted to such topics as tuberculous fibrins, cystin, cystinæmia, etc.

All the generally adapted methods are neglected for the author's own methods of direct examination of the fresh blood, which he claims enables him to diagnosticate tuberculous, syphilis, rheumatism, etc.

The ordinary methods of cell counting and hemoglobin estimation are rejected for methods which are absolutely crude and worthless.

To discuss the work in detail is a painful and profitless task. One might cite the chapter on tuberculosis and syphilis as example. In the latter much is said of the "spore of syphilis," yet not a single reference to the enormous literature on the bacteriology of this subject. Nor is there any reference to the Justus test in this disease. A more fragmentary and equally worthless text and series of illustrations than that found in the chapter on malaria cannot be found in medical literature.

The author's excuse for many of his conclusions is that their general acceptance may not readily be granted, since they are ahead of the times! He would have subserved a far more useful purpose had he patiently waited and published them when the times were a-breast of them. And the apology would then have been superfluous.

Works such as the one under review are most pernicious in their effects, and the reviewer would enter a most vigorous protest against the publication of such views, which are as misleading as they are unwarranted.

M. M.

Illinois State Dental Society.

At the annual meeting of this society, held at Springfield, May 13-15, 1902, the following officers were elected for the ensuing year: President, A. H. Peck, Chicago; vice-president, W. E. Holland, Jerseyville; secretary, Hart J. Goslee, Chicago; treasurer, C. N. Johnson, Chicago; librarian, J. T. Cummins, Metropolis; committee on science and literature, G. V. Black, Chicago; committee on art and invention, L. S. Tenney, Chicago; board of examiners, C. B. Sawyer, Jacksonville; committee on ethics, E. A. Royce, Chicago; G. E. Warren, Pontiac; E. F. Hazell, Springfield; supervisor of clinics, C. P. Pruyn, Chicago; executive committee, Chas. J. Sowle, Rockford; members of executive council, E. K. Blair, Waverly; D. M. Gallie, Chicago; O. M. Damude, Monmouth; publication committee, Hart J. Goslee, chairman; D. M. Cattell, G. W. Dittmar, Chicago; local committee of arrangements, F. H. McIntosh, J. B. Brown, G. D. Sitherwood, all of Bloomington, which city was selected as the next place of meeting.

The Georgia State Dental Society.

At the thirty-fourth annual session of the above society, held at Macon, Ga., June 14, 1902, the following officers were elected for the ensuing year: President, J. M. Mason, Macon; first vice-president, S. D. Rambo, Marietta; second vice-president, J. M. Whitehead, Vienna; treasurer, H. A. Lowrence, Athens; recording secretary, S. H. McKee, Americus; corresponding secretary, O. H. McDonald, Atlanta. Executive committee—Chairman, G. S. Tigner, Atlanta; G. T. Gurr, Waverley Hall; C. Z. McArthur, Fort Valley; C. Whittington, Valdosta; M. N. Mixon, Rome, and W. H. Weaver, La Grange.

The next meeting will be held at Tallulah Falls, June 9, 1903.